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Structural Scoliosis: Treating It by the Minerva Type of Distraction Body Jacket and Multiple Spine Fusions

Foster Matchett, M.D.

Since the work of the orthopedic surgeon deals very largely with the function of the locomotor apparatus, and since physical therapy ministers to a large proportion of patients with dysfunction of the locomotor apparatus, there is perhaps a closer relationship between physical therapy and orthopedic surgery than between physical therapy and any other specialty.

The late Doctor Lovett of Boston made the following statement: "What the prevailing treatment of scoliosis is today cannot be stated in a few sentences. Some men advocate one method, some another. To those who believe that forcible correction has accomplished more than any other treatment and will accomplish more in the future, the development of the real treatment of scoliosis dates from 1875. To those who believe that the gymnastic treatment of scoliosis is the best and that forcible correction is wrong, the progress in the matter of scoliosis starts with Hippocrates and comes down in a wavering and discouraging line from that date until the present, with a better knowledge of the affection on the whole, with probably some more effective gymnastic technique, but without any very great advance within the last hundred years in the line of efficiency."

Much has been accomplished during the last forty years in the treatment of the patient with severe scoliosis, and an impetus for the development of more satisfactory methods has come from the better understanding of the pathogenesis of scoliosis as well as the realization that a very good degree of correction can be obtained. Bradford and Brackett, Lovett and Brewster, Abbott, Forbes, and Hibbs and Galeazzi were the earlier workers whose methods of correction gave such encouraging results that other applications of their principles have been developed and still better results are being obtained.

Traction on the spine was one of the earliest forces applied for correction. In the fixed curved spine, a traction force sufficient to move the curve was unbearable to the patient, but it always has been recognized that such a force, though moderate, is of value. This force stretches the contracted muscles and ligaments and distracts the articulations and when constant, even though moderate, has a definitely corrective effect.

Perhaps there is no more difficult deformity to correct in the field of orthopedics than curvature of the spine. This is particularly true when the curvature is found in the high dorsal position.

Definition: Scoliosis or lateral curvature of the spine is a condition in which a series of vertebrae remain constantly deviated from the normal spinal axis; the lateral deviation is invariably accompanied by some degree of rotation of the vertebrae. Scoliosis is a deformity rather than a disease and is most often secondary to pathologic changes outside of the spine itself.

Incidence: Lateral curvature is one of the most common deformities of the spine. Its onset usually occurs during the years of growth. The factors which result in scoliosis

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often are established long before the child reaches school age, and definite deformity usually is recognizable before the age of fourteen years. In the early school ages scoliosis is more common in boys, but during adolescence it occurs three times as often in girls.

Structural scoliosis is characterized by definite morphologic abnormalities, and it is with this group of cases that therapeutic effort is mostly concerned.

The causes of structural scoliosis are numerous. A small group of the cases definitely are congenital in origin; a clear example is lateral curvature due to the presence of a hemivertebra. Pathologic changes in the bones, such as those of rickets, may so impair the strength of the spinal column that postural and gravitational stresses cause the development of scoliosis. Asymmetrical paralysis in poliomyelitis or muscular dystrophy frequently leads to scoliosis by destroying the normal balance of the supporting musculature. The collapse of the lung by thoracoplasty and the contraction of the thoracic in chronic eympyema (pleurogenic scoliosis) often will lead to curvatures of the spine. In many instances of scoliosis, however, the pathogenesis is unknown. In these cases of so-called idiopathic scoliosis the underlying factor has been assumed to be a functional weakness or insufficiency of the spine, and by some observers such weakness has been thought to be of congenital origin.

The changes are in the muscles, ligaments and fascia, and also in the architecture of the vertebral bodies, the articular facets, laminae and spinous processes are perhaps comparable in all of them but vary in degree in the individual case, and therefore the combination of these changes is different in each case. Furthermore there is in each case a different response to corrective pressure, to traction and to operative stabilization, so that it is only natural that the end result tends to vary greatly in each case.

From Brogden[2] we have a review of some 500 cases of scoliosis treated at the Hospital for Ruptured and Crippled in New York City and a few facts relative to scoliosis which have been gained.

1. Scoliosis is more common in females than in males in the ratio of two to one.

2. The average age of patients when they present themselves for examination is twelve years, the average age at the time of operation is fourteen years.

3. Idiopathic cases of scoliosis are twice as frequent as poliomyelitis cases.

4. Fusion does not always relieve pain.

5. Fusion is successful, insofar as solid bony union is concerned, in 66 per cent of the cases.

6. The general health of the patient is improved in about 83 per cent of the cases and the general contour in only 50 per cent of the cases.

7. The use of an autogenous bone graft assures a more solid fusion than does the Hibbs technique alone.

8. A two-stage operation is indicated if the curve extends through more than eight vertebral bodies.

9. The frame treatment is safer, interferes less with the vital capacity and permits the patient to be more comfortable than any other form of corrective apparatus.

10. In spite of fusion, 23 per cent of the cases showed an average increase of 14 degrees in the angle of deformity.

11. All patients subjected to spine fusion should wear some type of support for at least eighteen months after the operation.

12. Cases of idiopathic scoliosis respond more favorably to treatment than any other type.

13. The operation should not be performed before ten years of age if solid fusion is to be expected.

14. In cases of scoliosis in which poliomyelitis is the etiological factor there is a greater frequency in postoperative deformity, and a greater degree, than in any other type.

15. The mortality rate as the result of the fusion operation is practically negligible.

None of these structural cases can be cured.

As regards treatment it must be decided first whether treatment is at all necessary in some cases. It would appear certain that a small proportion of cases reach a natural compensation with a minor degree of deformity and especially is this so toward early adult life.

Methods of forcible correction may be divided into traction and pressure methods on one hand, and the derotation and inclination methods on the other.

In a number of other methods of treatment, a position of compensation is sought, rather than a maximal correction of the curve. This principle was enunciated more fully by Steindler in a paper on the compensation treatment of scoliosis in London in 1929.

Herein lies the significance of Lovett's observation that, "It is easier to displace the

scoliotic section *en bloc* than to correct it." Displacement *en bloc* means displacement by compensatory curves.

The maintenance of position may be expected in time to produce a change in the shape of the vertebrae, according to Wolff's law. Lane has demonstrated skeletal changes in response to heavy loads. Structural scoliosis can be produced experimentally by constant long continued malposture. Bone under pressure changes shape after growth has been reached.

Thoracogenic scolioses are of two types: pleurogenic and thoracoplastogenic. Both are preventable and curable if corrected in their incipiency.

Pleurogenic deformities can be prevented by (1) the prevention of the formation of pleural scar by early cure of the empyema or pleuritis, and (2) the constant attention to maintenance of straight alignment or preferably of overcorrection of the spine. This can be accomplished by means of (a) postural wedging, (b) corrective body casts of plaster of paris and (c) resection of ribs on the side of concavity.

It is a known fact today that the best results in structural scoliosis have been obtained by using forcible correction, plus surgery, plus active exercise.

Having been fortunate enough to spend some sixteen months on an orthopedic service in Boston, I contacted many capable, well-known orthopedic surgeons. Each in his time had certain definite ideas about the treatment of structural scoliosis. Such men as Doctors Frank Ober, John Kuhns, Joe Barr, Brewster, M. N. Smith-Petersen, Arthur Legg, and others are greatly respected and a method of treatment sponsored by any one of them would demand respect and careful consideration, regardless of its national acceptability. Such a situation exists in Boston, making it an ideal training ground for the student orthopedist. Naturally, it leaves him in a state of confusion, making it necessary for him eventually to find out for himself, usually through experience (trial and error) which method he, himself, will choose and decide to sponsor for his method of treatment. Fortunately for me, however, I had the pleasure of being resident for three years for Dr. John Royal Moore at Shriners' and Temple University Hospital in Philadelphia. Being keenly interested in scoliotic problems himself and having the hospital facilities available at the Shriners' Hospital, Doctor Moore began to study these cases, and, influenced by his enthusiasm, I became interested in this work. The usual type of physical therapy exercises were used for the functional curves. The structural curves were treated more radically. If it was possible to determine that the structural changes were on the increase regardless of the extent of the deformity, the radical approach was followed. Mobilizing corrective exercises first were carried out, after which the patients were placed in the Minerva type of body jacket.

The Minerva type of body jacket was applied with the patient standing on tiptoes with the traction applied to the chin occiput area. In this way we were able to get the shoulders directly over the pelvis. Considerable snug-fitting felt was used over all bony prominences.

About three days later the head portion of the cast was applied. The patient was hung head down in the body jacket with the support coming around the center of the cast. The result was that the body jacket fit snugly over the shoulders and pelvis, and the neck was stretched full length. This same day four right-angle type of turnbuckles were incorporated into the plaster, two in front and two behind.

About two days later, the cast was divided into two portions, top and bottom. The initial distraction amounted to one-half inch; after this about one or two turns every second and third day was sufficient for progress and for the patient's comfort. A careful record was made of all progress, complaints and separation. The four turnbuckle bolts always were turned up the same amount at each turning. When there were any complaints of burning over any bony prominences, the turnbuckles were turned back a few turns and progress halted for a few days. (At this point watchful care is very important as pressure sores on chin or ilia retards progress.)

The spine was checked by X-ray at intervals, usually every two weeks. These children were never permitted to be up and about during the treatment stage as atrophy or decalcification from long immobilization and restriction of calcium in the diet all played their part in softening the spine, relaxing the muscles and ligaments, and ultimately helped to straighten the spine.

It is fully appreciated at this stage that traction applied to the ends of a sagged rope can more nearly straighten this rope than bending it at one point or another can produce the

desired result. However, it is mathematically known and an engineering fact that the closer the suspended rope or cable approaches a straight line the tension necessarily applied does not increase by arithmetic but by geometric progression. In other words, if fifteen pounds traction were necessary to make marked changes in the relaxed small diameter curve by the time the curve was nearly straight, the traction might have to be twenty times fifteen pounds, which would be prohibitive and naturally it would cause the patient marked discomfort from pressure sores and so forth. Therefore, we were more or less content when a certain point in correction was reached in the minimal length of time, realizing that many fixed curves were already fused. Correction varied anywhere from two to six months. At this point the previously chosen spine fusion areas were fused.

Before proceeding further, let me state that the first stage in the correction of these structural curves was adequate preliminary X-rays. The following routine X-rays were taken: entire spine—anterior-posterior and lateral, lying, sitting, and standing, also with compression to head and shoulder and with the patient suspended by a chin occiput halter with toes just barely touching the floor. These X-rays were routine and from their study we were able somewhat to prognosticate the break points in the spine and locate the sites of fusion and tell somewhat of the possibilities of correction. The average number of fusions was two plus as most of the cases demanded three fusions.

The choosing of three fusion points and thus stabilizing possibly three curves with an average total of twelve vertebrae and three minor operative procedures was conceived and worked on entirely by Doctor Moore, and to him is due all credit for its success.

With the fusion of a large so-called primary curve which was extremely severe and rigid, we were confronted with the problem of giving the patient a poker back after a very extensive operative procedure which in most surgeons' hands requires two stages. At the same time there still will be two compensatory curves remaining the lower of which even yet may have to be fused.

Analyzing a scoliotic curve of the S-type, we notice that there are certain sections of the spine where the bodies of many of the vertebrae play little part in the formation of the curve. If these sections can all be brought into vertical relationship to the pelvis, the spine will be straight. Those which take an active part in the curve are few and can be distinctly pointed out. These minimal break points are fused after correction in the cast and the back is assured of trunk height, shoulders over the pelvis, and no break in the spine at the old break points. The fusion is done through a window in the cast. The morning of the operation, a heavy No. 20 hypodermic needle under local anesthesia is thrust down deeply into the poster or spinous process of one of the prominent vertebrae in the proposed fusion site, and a lateral spinal X-ray is taken, including enough sacrum to insure location. In this way there is no question of the number of the vertebrae included within the fusion. We usually fuse the most severe curve first, then the lowest curve, then the upper. Many times the fusion of the upper may be omitted, or it may be postponed for a while if the patient's condition will not permit.

The operative procedure of fusing four vertebrae takes about thirty-five to forty-five minutes if done by an experienced full team —surgeon, resident, intern, two operating assisting nurses and a circulating nurse. Various fusions have been tried, each has its virtues; the Albee fusion for speed but less dependable and less flexible for general use; the Freiberg operation good for severe rotation deformities; the straight Hibbs fusion only 66 per cent dependable for bony fusion. Some men use osteoperiosteal grafts with the Hibbs fusion, but we feel that a careful Hibbs fusion reinforced either by strips of cortical bone from the tibia or simply by cortical chip grafts from the tibia are more dependable. In fact we have made it a practice to explore the fusion a month before discharge. A second fusion usually can be done about two weeks later, and if a third is needed, about four weeks is allowed to pass. The patient is kept in the cast for a minimum of eight to twelve weeks following the last fusion, after which a new light body jacket is applied with the patient in traction. This is worn for one to three months as the patient gradually is allowed to start weight bearing and strengthening exercises. This cast is bivalved and under careful physical therapy supervision the back extensors, abdominals, and hip flexors and glutei are exercised. (I neglected to mention that throughout the long hospitalization and "getting up" period, the physical therapists are always on hand, using whatever physical agents are available to keep the little arms and legs and other exposed parts toned up to

their normal state.) Active exercises for the extremities are encouraged and passive exercises are given when necessary. When the light cast has served its usefulness and the child's condition permits it, a Taylor type of back brace with ilium crutch supports is fitted. The patient continues in this brace until growth of the spine has ceased or in the older children for twelve to eighteen months. They continue to receive physical therapy supervision weekly, monthly, and then every three months. No surgeon should attempt such treatment if he is not patient, sympathetic and optimistic and devoted to his work as it is a tedious type of work, a long drawn out type of therapy, but one which we feel is effective and worth the time and effort consumed. Since this work is as yet unpublished by Doctor Moore, with his permission I am presenting to you a preliminary report of this work.

The operative, corrective procedures are more interesting technically than the designing and fitting of a holding apparatus, but if one visualized the procedures as a whole and also the end result, he should be as much interested in the latter as the former and therefore become meticulously careful that the holding apparatus which is selected really holds the spine in the correct position. Nor should his interest fail at this point for the result depends as much upon the follow-up as it does on the preliminary stage of the endeavor. Especially is this true of the effort to get a good back from the treatment of scoliosis because scoliotic spines show a greater tendency to relapse than do other orthopedic conditions. By a "good back" is meant one that maintains a more or less erect position without strain, fatigue or conscious effort and with body lines which are not noticeably asymmetrical when the patient is dressed.

However, we must always remember that each case is an individual problem. We do not believe that a distractor apparatus should be used in every case of scoliosis. The principle of correction must be borne in mind. Although good results were obtained in all our fifteen cases, we were careful to choose the types of patients suited for this procedure. It should not be attempted on an obese cachectic or highly nervous individual.

We believe in some instances that it is a good plan to combine or to alternate simple distraction with the methods of Hibbs, Risser, and Ferguson, Galeazzi and others.

One might say that this long casting and operative therapy is rather an heroic procedure, but when we consider that structural scoliosis will tend to increase until the person stops growing, and that the patient will be obliged to wear apparatus until that time, I feel that we are quite justified. Condemning a girl of 7 or 8 to a plaster or a steel and leather jacket until she is 17 or 18 years of age, with very little hope of correction, and in all probability an increasing curve, I believe is a much more radical procedure than forcible correction, plus surgery, plus gymnastics.

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Recent Developments in Physical Therapy

Frank H. Krusen, M. D.

The advance of physical therapy as a phase of rational medical practice has continued apace during the last few years. Physical therapy comprises the treatment of disease by means of the physical, chemical and other properties of light, heat, water and electricity, and also by means of mechanical agencies, including massage, exercise and various devices.

LIGHT

Ultraviolet radiant energy.—One of the most interesting recent developments in the application of ultraviolet radiant energy to medicine is its use in sterilization of the air in hospital wards, corridors and operating rooms. Wells[1] has shown that air-borne infections are not uncommon and that in enclosed rooms respiratory flora are exchanged between patients. Thus, air which is breathed commonly by various individuals inevitably transfers organisms from one person to another.

Wells has suggested the irradiation by means of ultraviolet light of recirculated air in ventilating systems, and he has further observed that the direct irradiation of the whole room is still more effective for sterilization of the air provided the eyes of the occupants of the room are protected from the rays.

McKhann, Steeger and Long[2] experimented with this procedure, as recommended by Wells, to determine whether the spread of chickenpox could be prevented in the hospital by setting up a barrier of ultraviolet radiation across the corridor of an isolation ward. Preliminary tests showed that the barrier was adequate to prevent the spread of colon bacilli sprayed into the air except when gusts of wind were permitted to sweep past the lamps. For five months the so-called chickenpox section separated by the barrier contained patients who had active disease. One of the 120 children beyond the barrier acquired chickenpox; however, the infection was traced to a nurse who had the disease. They concluded that although technical errors sometimes are unavoidable, ultraviolet sterilization of the air deserves further trial as an added means of diminishing air-borne infection.

To test the bactericidal effectiveness of ultraviolet irradiation in the operating room, Hart[3] performed 132 operations (extrapleural thoracoplasty) on 59 patients in a field of air sterilized by means of ultraviolet radiation. Results were compared with 110 similar operations performed in air not thus sterilized. They reported that the mortality was reduced to half by elimination of severe infection of the wounds, there being three deaths among patients operated on in the irradiated field and six deaths in the comparative series. When the air was irradiated, wounds healed more rapidly and with less reaction; the postoperative course was greatly improved; postoperative pain was said to be less, and convalescence was more rapid, than among patients not operated on in an irradiated field.

Infra-red radiation.—In the field of infrared radiation, recent studies by Hardy and Muschenheim[4] have shown that the transmission of such rays through the skin is not great. Their observations indicate that even the most penetrating near-infra-red rays are absorbed largely in the outermost layers of the skin, about 95 per cent of the rays being absorbed within 2 mm. of the surface, and 99 per cent within 3 mm. of the surface. This recent observation is of considerable significance, in view of the fact that it has commonly been thought that such radiation penetrates to a considerable depth.

HEAT

Much evidence has been accumulated recently on the value of general applications of heat in the treatment of various diseases. Many new types of apparatus for the production of generalized heating of the human body have been developed. The devices which have proved most satisfactory are the hot humid air cabinet and the combination of such a cabinet with short wave diathermy. The ap-

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Read before the meeting of the Minnesota Physiotherapy Association, St. Paul, Minnesota, May 26, 1939.

plication of fever is an important adjunct in the treatment of resistant gonorrhea and it has been used to advantage in the treatment of such diseases as chorea, syphilis of the central nervous system and undulant fever.

One of the most important recent developments in fever therapy is the realization that the combination of fever and chemotherapy is more effective in the treatment of certain diseases than is the application of either form of therapy alone.

White,[5] working in the department of pharmacology and experimental therapeutics at Johns Hopkins University, has shown recently that 10 mg. per cent of sulfanilamide was bactericidal against 1000 times as many bacteria at a temperature of 39 C. (102.2 F.) as it was at a temperature of 38 C. (100.4 F.); that with an average initial bacterial concentration of 500 per c.c., about 100 times as much sulfanilamide was required to sterilize at a temperature of 37 C. (98.6 F.) as at 39 C. (102.2 F.). The activity of sulfapyridine in vitro appears to be similarly influenced by small changes in temperatures between 37 C. and 39 C. (98.6 F. and 102.2 F.).

At The Mayo Clinic, our clinical observations would tend to support these in vitro observations of White. We have found that in the treatment of gonorrhea a combination of fever therapy plus sulfanilamide therapy is much more effective than either procedure alone. Thus, in a series of 53 patients who had failed to respond to apparently adequate sulfanilamide therapy and other means of treatment, prostatic and urethral cultures became negative for Neisseria gonorrhoeæ in all but one instance following the application of a combination of sulfanilamide and fever therapy.

Our results in the treatment of brucellosis by artificially induced fever have been encouraging, and in one instance the combination of fever therapy plus sulfanilamide therapy proved more effective than either alone.

WATER

Among the recent developments in the application of water to the treatment of disease may be mentioned the description of a simple homemade whirlpool bath by Boynton.[6] Such a simple homemade bath, adapted from an ordinary copper wash boiler, often may prove effective in the treatment of certain circulatory diseases as well as in the treatment of traumatic lesions of the extremities. It produces its effect through a combination of sustained local heating with the gentle frictional effect of whirling water.

Another recent development in the field of hydrotherapy has to do with the perfection of a new device for the application of the so-called Elliott treatments in the large intestine through the colonic stoma. Welch,[7] while he was at The Mayo Clinic, found that if heat could be applied by means of a special applicator to the intestinal wall in the Mikulicz type of colonic resection, the edematous inflammation would subside, permitting earlier approximation of the loops of the bowel and lessening the period of hospitalization between the first and second stages of the operation. Clamps cannot be applied effectively to the edematous, thickened spur of tissue so frequently encountered after the first stage of this operation, and unless this procedure is employed, deliberate delay often is indicated between successive steps. Such a procedure as Welch's, then, would seem to be of value in simplifying a difficult operative procedure.

Still another interesting recent development in hydrotherapy has to do with the application of contrast baths in the treatment of rheumatoid (atrophic) arthritis. Woodmansey and his associates[8] have demonstrated that the usual practice of applying contrast baths for alternate periods of one minute each does not produce satisfactory responses. After a series of carefully controlled studies, they found that the best reaction (active contraction and relaxation of blood vessels and increased flow of blood) is obtained when hot water is applied for six minutes and cold water for four minutes. The next best reactions were obtained with applications of hot water for seven minutes and cold water for five minutes.

At The Mayo Clinic, our attempts at confirmation of the observation of Woodmansey and associates have not been completely successful, possibly because our American patients are used to warmer houses and a warmer environment. Our patients have tolerated best such treatments with shorter periods of cold not exceeding three minutes, and often not longer than two minutes. It does seem advisable to use the hot applications for at least five minutes, and at present we most frequently apply contrast baths using a five-minute exposure to hot water and a two-minute exposure to cold water. Better responses should be obtained by this procedure than by alternating one minute hot and one minute cold. The treatment always should begin and end in the hot water.

ELECTRICITY

An interesting recent development in the treatment of peripheral vascular spasm has been the perfection by Bennett[9] of the Section on Physical Therapy at The Mayo Clinic of a method of treatment by short wave diathermy. With this technic, an induction cable is applied in pancake formation of four turns over the lumbosacral region of the patient, or two pads are employed. The coil is spaced at least one to two inches from the bodily surface by means of turkish toweling, or better still, by means of a rubberized fabric-covered hair mattress. The current is increased until the patient experiences a sensation of comfortable heat, and treatment should be continued for one hour or more. The temperature of the room, preferably, should be between 80 and 84 F. (26.6 and 28.8 C.). In using this procedure in treating peripheral vascular spasm of the lower extremities, there is frequently a marked vasomotor response, with a considerable increase in the temperature of the extremities. Whereas other methods may produce an equal response, Bennett has found this procedure to be the most comfortable for the patient, as well as being readily controlled.

In considering recent developments in electrotherapy, the need for controlling[10] unwarranted enthusiasm for the use of short wave diathermy should be emphasized. Many exaggerated claims have been advanced concerning the value of this physical agent. For example, it has been claimed that low energy machines which do not heat the tissues will produce certain physiologic effects. It has been claimed that short wave diathermy will produce specific bactericidal effects, that it will produce selective heating effects and specific physiologic reactions. Present studies would tend to indicate that such devices produce no effect at low energy output other than a psychic one; no selective heating effects in the living; no specific bactericidal or physiologic effects other than those attributable to the heat which is produced. It will produce more homogeneous and deeper local heating of bodily tissues than can be obtained by any other means.

One other recent development in the field of electrotherapy should be brought to attention: it deals with the problem of interference with radio reception by electromedical equipment. Efforts are now being made to control the use of electromedical apparatus in such a way that it will not interfere with radio reception and television. In a current editorial,[11] it is pointed out that the beneficent exploitation of electromedical apparatus is now being challenged by the counter-interests of industrial and governmental bureaus, the reason being that the employment of such apparatus tends to interfere with radio reception in general, and in particular, with that much publicized, but still unborn prodigy of the radio amusement world, television.

It is emphasized that the situation confronting the medical profession at this moment is that restrictive legislation is contemplated in order to curtail interference with radio communication by electromedical equipment. It is being urged that physicians either screen their apparatus or so modify its construction by the introduction of what is known as a "crystal control," so that interference will be minimized. Or, it is suggested that physicians operate their machines only at certain hours. Still another suggestion is that physicians confine their apparatus to a type which will broadcast only on certain wave lengths and hence will limit radio interference. None of these solutions can be achieved without imposing a serious financial burden on both the physician and patient.

At this very moment, steps are being taken to urge Congress to increase the powers of the Federal Communications Commission so that it will be legally empowered to enforce such restrictions on the medical profession. As the editorial states, scientific medicine has been asked "to plead for the right to use this new spectacular healing force in medicine and surgery—to plead for the legal privilege to minister to the sick and dying before a tribunal of well intentioned but misguided lay individuals."

I[12] have recently pointed out that physicians desire to cooperate to the utmost in any plan for preventing radio interference, but that it is felt that in any scheme for developing such control, the life and health of our populace should be given first consideration. It seems almost unbelievable that pain-relieving and life-saving measures should be weighed in the same balance with undeveloped forms of home amusement.

All who are interested in protecting the use of electromedical apparatus should communicate with Dr. John S. Coulter, chairman of the Medical Committee on Radio Interference at Northwestern University in Chicago, and volunteer their services. He will supply

to physicians and others concerned necessary information, so that congressmen and senators may be informed of the seriousness of this problem. In such a manner, the best interests of physical therapy may be protected.

MECHANOTHERAPY

Mechanical devices.—Among the interesting recent developments in mechanotherapy may be mentioned a special type of tilting bed which has been found to be effective in improving the circulation of patients having certain types of cardiac and vascular disease. This tilting bed permits the patient to lie at ease. It moves mechanically in such a manner that the patient's lower extremities are tilted first downward, then upward, thus automatically aiding the circulation in the extremities. Properly used, the device has some merit.

Massage.—An interesting new development in the field of massage has to do with the treatment of coccygeal pain by means of internal massage of the muscles attached to the coccyx. Thiele[13] has pointed out that in many instances pain in the region of the coccyx is caused by spasm of the levator anicoccygeus and piriformis muscles. In association with certain collaborators, he applied internal massage to these muscles and reported frequent relief of symptoms.

I have tried Thiele's procedure in combination with external applications of heat and external massage to the region of the coccyx, plus exercises performed in a manner somewhat similar to that described by Duncan,[14] and have found that it is somewhat beneficial for patients suffering from coccygeal pain. Thiele and his collaborators reported that 60 per cent of his patients were "cured" and that 33.7 per cent were definitely improved. I communicated with thirteen patients for whom I had prescribed this treatment, and found that nine were partly improved, three reported little if any improvement and one was unimproved. A sufficiently large number of our patients showed definite improvement to make me feel that this procedure has considerable merit and that it should be used more frequently, at least for a period of six months before removal of the coccyx by surgical means is performed.

Another form of massage which should always be considered and which has only recently been given serious consideration in this country is the heavy massage which is to be applied to patients who have fibrositis. Fibrositis is a chronic inflammation of the white fibrous tissue of the body, frequently characterized by the presence of painful indurations or nodules which are commonly located in the back of the neck along the upper border of the trapezius muscle or in the lower back in the region of the sacrum. In England and on the Continent much has been written concerning the use of heat and heavy massage in the treatment of fibrositis. Extremely heavy massage over these painful nodules often produces great relief. It must be applied in a skilful manner by one who has a clear knowledge of the procedure. I have described this condition in more detail elsewhere.[15]

Exercise.—One of the most important recent developments in the application of exercise to the treatment of disease is the compilation of a system of physical exercises to be performed by patients who have asthma. The British Asthma Research Council has published an excellent booklet on physical exercises in the treatment of asthma.[16] We at The Mayo Clinic have found these exercises to be extremely valuable as an auxiliary measure in the control of asthmatic attacks, particularly in treating children. The booklet consists of three parts, the first dealing with elementary exercises, the second with advanced exercises and the third with children's exercises.

When performing these exercises, the patient should begin with a quiet inhalation through the nose, taking a small breath only, followed by a long exhalation through the mouth, making an "F" or "S" sound with the lips and teeth. The idea of the program of exercise is to teach the patient voluntary control of his muscles of respiration in order that he may overcome much of the discomfort of the asthmatic attack. Once the exercises have been mastered, considerable relief may be expected.

There is one other mechanical procedure which offers some hope of relief of a common complaint associated with arthritis of the neck. It has recently been pointed out by Turner and Oppenheimer[17] that secondary neuritis with pain in the shoulder, arm or chest is frequently associated with hypertrophic arthritis of the neck. It has been found[18] that if gentle traction is applied to the neck by means of a Sayre or homemade head sling and the head is gently but forcibly rotated to the right and left, the secondary neuritis often may be partially or wholly relieved. It has been my custom to apply

this treatment by means of a Sayre head sling, and then to instruct the patient in the continuation of the procedure at home by means of a simple homemade head sling. Results have been sufficiently satisfactory to warrant a continuation of this procedure. The cervical traction is frequently augmented by local applications of heat and massage to the neck.

CONCLUSIONS

Physical therapy continues rapid development and many new innovations are seen from year to year. I have endeavored to describe briefly some of the more interesting and simpler of these recent developments, knowledge of which, I hope, will prove advantageous to individuals practicing or concerned with the various aspects of physical medicine.

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This year Sweden is paying tribute to the memory of Petter Henrik Ling, who died in 1839, at the age of 63. It is no mere chance that this year the Swedish government is opening an institution for the teaching of the physiology and hygiene of bodily exercises. At the time of his death Ling was head of the Central Gymnastic Institute, honored at home and abroad. His father, a poor clergyman, died when Petter was two years old so he was brought up in very humble circumstances. He graduated from the University of Lund and continued to study in Uppsala, but he never qualified as a physician. Although his gifts as a poet and author were very promising, it was in gymnastics that he earned a place in the history of medicine. During the century since his death there have been many developments in gymnastics, yet the principles he laid down are held to be as sound today as they were when his forceful personality was behind them. The Central Gymnastic Institute, which he founded, has remained a school for the teaching of gymnastics in health and disease, maintaining the high standard which has placed Swedish gymnastics in so prominent a position in the world. He made gymnastics a national movement which, beginning in the schools and soldiers' camps, came to inspire the whole community.

At first the public was inclined to jeer at a man fanatically devoted to the light he followed. But the medical profession took him and his cause seriously and the Swedish Medical Society honored itself by electing him a member in 1831. He seems to have been as frail of body as he was forceful of spirit. As a young man he was told by his physician that he was suffering from consumption. After his death examination proved this diagnosis correct and showed that death was due to a malignant disease of the liver. He had been subject to violent attacks of coughing and his respiration had been labored, but the vitality of his spirit dominated the frailty of his body throughout his life.

The Role of Physiotherapy in Psychiatric Treatment

Oskar Diethelm, M. D.

Psychiatry is the branch of medicine which deals with the study and treatment of disorders of the personality. This modern formulation goes far beyond the older concept which included merely so-called "mental" disorders, frequently considered synonymous with brain disease. The separation of mental and physical has been abandoned, recognized as incorrect, and as impeding investigative studies and progress in treatment. The personality is conceived as a unit in which the body with its anatomical structure and physiological functions cannot be separated from so-called psychic or mental activities. Treatment is based on the recognition of this fact of psychobiological integration. Without it, physical therapy would not have a valid scientific basis. Although physiotherapy is still primarily empirical, based on insufficiently studied therapeutic results, it does not need to remain so any longer. With further progress in physiological, psychological, and psychiatric research, light will be thrown on what actually happens in an individual under the influence of hydrotherapy, massage, physical activity and other physiotherapeutic procedures.

It is important that one keep in mind that every person is an individual with his own development, his inherited constitutional make-up shaped by a multitude of life experiences. The individual's personal history explains various types of sensitiveness to different situations in life. No physiotherapeutic procedures can be administered in their best form and the results evaluated if this is not considered carefully.

The physiotherapist must be aware of possible emotional reactions which result from stirring up unpleasant memories or sensitivities, interfering with his therapeutic efforts. Furthermore, each person has his own attitude to the future, varying from carefree unconcern to anxious anticipation and fear. In carrying out a given task, his attitude will be influenced by his standards and his expectations of himself. Some persons, for example, have a large amount of self-confidence while others lack it considerably and feel inadequate even to minor tasks of life. Such inadequate persons wish to lean on others and must therefore develop increasing confidence in themselves by performing tasks for which they are fit. Emotional reactions may occur readily, or they may occur slowly, and there may be varying degrees of intensity and control. These reactions are either quite obvious to the onlooker or else hidden from him behind a mask of indifference. Encouragement and praise, corrections or slighting remarks produce widely different results. One should also keep in mind that while new situations may be grasped readily by some, in others they cause perplexity and uneasiness. This reaction does not depend merely upon the general intelligence, but also largely upon one's emotional state. Anxiety, fear and tension interfere to a considerable extent with the intellectual functions. In a tense or fearful person, some procedures must be explained repeatedly while the same person in a state of ease will understand them at once.

The individual attitude to the group may necessitate modifications in the physical therapy approach. Individual attention and activity may permit a person, who is self-conscious primarily because he lacks self-confidence, to gain belief in his ability to do as well as other members of the group. Having reached this point, he will feel enough at ease to fit into group activity and benefit from it. In others, self-consciousness may be due to thinking too much about the impression they make on others. Such self-conscious persons may become at ease by being taken as merely part of a larger group without being singled out by the instructor. Then again, being taken as part of the group but receiving special encouragement or praise will help a third type of self-conscious person. In evaluating physical endurance, one should consider

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not merely the physical condition, but also the general emotional state and the interests involved. The attitude to one's body may vary greatly, dependent upon one's life experiences, upon emotional factors which play a role at the present time and upon one's strivings and goals. It is frequently most difficult to determine to what extent complaints of fatiguability are caused by faulty life habits, by overconcern due to a generally discouraged or depressed mood, or by a physiological inadequacy. Sensitiveness to pain varies physiologically but is also largely dependent upon one's emotional state.

The personality of the one who administers the treatment is an important factor. The physiotherapist should be aware of his own outstanding personality features, recognize their desirability and undesirability and deal with them accordingly. There is no doubt that the best results are obtained by a calm and patient person who is interested in his work and whose whole behavior expresses confidence in the worth and therapeutic effectiveness of what he is doing. The patient's response depends upon the treatment as well as upon the person who administers it. The personal relationship between instructor and individual patient and between instructor and the group which includes the individual patient deserve constant scrutiny. The instructor should analyze his own behavior and his various reactions as well as those of the patients. He should try to find out the factors which make for success at one time and for failure at another. The analysis of success will show him the constructive features of the physiotherapeutic procedure, of himself and of the patient. The understanding of nonsuccess will clarify the shortcomings which should be avoided or, if possible, overcome in future treatment.

This brief discussion illustrates the necessity of studying and understanding the person "in the setting of his development but living at the present time and having his characteristic attitude and anticipation to the future. All these factors, the present personality with his biographic development and his attitude to the future, need to be considered and evaluated carefully. Whatever can be modified, whether it deals with the personality functions in a narrower sense or with the somatic condition, with work or environmental factors, needs to be utilized therapeutically."*

*From O. Diethelm: Treatment in Psychiatry. By permission of The Macmillan Company, publishers.

A natural expansion of psychiatry occurred when the individual personality and its malfunctioning were considered the primary concern. Previously the psychiatrist limited his medical activities to patients suffering from major difficulties, usually treated in mental hospitals. Realizing the necessity to include in his field all kinds and degrees of personality disorders, he increasingly turned his attention to patients in general hospitals and in the general field of medicine. He found opportunities for study and treatment in all age groups. The small and older child, the adolescent, the adult and the aging person are confronted with different life situations, reacting to them according to their physical condition and their personalities. Patients treated in office consultations by the general practitioner and by the various specialists, and persons who maintain an active life in apparently satisfactory health are benefited by psychiatric treatment. Therefore, the conclusion has been drawn by the medical educator that every future physician needs to be acquainted with the methods of psychiatric investigation and treatment. The well-trained physician will become increasingly equipped to recognize and treat the personality reactions of his patients and refer to the specialist, that is, the psychiatrist, those patients only who are in need of the specialist's skill. The physiotherapist must follow the psychiatrist in his progress and recognize the valuable contribution he can make whether the patient is in a hospital or on the outside, an invalid or a working person, an adult, or child or old person.

Physiotherapy has had its well-established place in psychiatric treatment. The value of hydrotherapy is generally recognized while that of other procedures is frequently disputed. Even with regard to hydrotherapy, however, one should frankly acknowledge that one knows relatively little about its actual influence on the body and on the personality. Prolonged warm tubs diminish excitement and produce rest and sleep. There are indications that this procedure influences the blood volume in various organs, leading to an increase in the skin, possibly a decrease in the central nervous system, and generally freer circulation of blood. Other physiological explanations also must be considered. Resulting muscle relaxation is important but little understood. It is even possible that the mere removal of irritating stimuli on the skin is more essen-

tial than other factors. Muscular relaxation, fatigue, a feeling of drowsiness and physical ease lead to sleep. They are increased by confidence in the therapeutic procedure, and disturbed by fear and anxiety. It depends largely upon the psychological skill of those who administer the treatment whether the influence is more or less beneficial.

Cold wet packs have the strongest hydrotherapeutic influence on excited patients. This has been explained by the "hydrotherapeutic shock" which through contraction and subsequent dilatation of the vessels of the skin leads to rapid circulation and interchange between the blood of the surface and the blood of the interior of the body. Warm wet packs are not supposed to produce the "hydrotherapeutic shock;" nevertheless, the therapeutic results with warm wet packs seem to be similarly beneficial if physician, nurse and patient believe in its efficacy. This observation forces one to reconsider the present formulation of the importance of the "hydrotherapeutic shock," as to whether it is valid or whether the emotional factor accompanying confidence in the treatment, that is, suggestion, is not more fundamental than is generally recognized. The practical conclusion to be drawn is most important: In every patient everything should be avoided which will cause fear or resentment. Prolonged warm baths and wet packs are very valuable in all personality disorders where motor or emotional tension or excitement are present, whatever the illness may be. It is used therapeutically to great advantage on patients in psychiatric hospitals, in many conditions in general hospitals, and in a modified form, in private homes.

Other hydrotherapeutic procedures have a limited value in psychiatric treatment. Cold sitz-baths, for example, help considerably to reduce sexual tension in the genital organs. For anatomical reasons, their efficacy is greater in women than in men. However, in advising such sitz-baths, the physician must keep in mind that the hydrotherapeutic local result is nullified if the patient's imagination and preoccupation stimulate his sexual desires. Through reflex influences, these sexual desires, which constantly increase the blood supply in the sexual organs, one tries to diminish through hydrotherapy. Good results can be obtained only if skilful psychotherapy of the psychiatrist can influence the patient's preoccupations. The stimulating value of other hydrotherapeutic procedures, so far as our present-day knowledge permits us to understand them, can be obtained just as well through physical recreation. Recreation has the additional value of being far less expensive, administrable at the same time to a large number of patients, and has the important asset of increasing the patient's healthy integration into the group.

The large hydrotherapeutic establishments which came in vogue at the beginning of the present century are of no specific psychiatric value. Treatment in such sanatoria is helpful because it forces the patient to lead a better regulated life than he did previously and to establish sensible habits of eating, sleeping and physical recreation. Fifty years ago physicians believed that most of the minor so-called "nervous" complaints were due to neurasthenia, which was conceived as an asthenia of the nervous system. Rest and hydrotherapeutic stimulation seemed indicated. There is sufficient evidence to prove the fallacy of this theory. In stating this fact, I do not wish to deny the value of stimulating hydrotherapy in patients of an asthenic physical constitution. It is the physician's task to evaluate the importance of hydrotherapy in each individual case and to plan carefully the psychotherapeutic and physiotherapeutic activities.

It is obvious that hydrotherapy is not applicable to definite diseases but to a great number of conditions in many illnesses. The indications and contraindications are little known. Physicians and physiotherapists are guided by their individual limited experience. Scientific literature offers little help. One point has been established beyond doubt. The hydrotherapeutic procedures affect the functions of the cardiovascular system. The same can be said of emotions. No satisfactory effects of hydrotherapeutic procedures can be expected if they stir up emotions which produce the opposite effect upon the cardiovascular system. Therefore every patient must be studied and treated with regard to the somatic and emotional factors. It is essential that the emotional reactions of anxiety, fear and resentment be prevented or alleviated if they already exist. The treatment should never be allowed to become mere routine or exerted under marked pressure of work.

It is not the purpose of this discussion to evaluate all the procedures in detail. Some procedures, such as electrotherapy or light

applications, have little or no known therapeutic influence on psychiatric disorders. They ought to be omitted. Massage no doubt has considerable value in the medical field. In personality disorders, their main beneficial effect is seen in states of emotional tension where circumscribed muscle groups seem to be affected. It is worth while to keep in mind that very little is known about the physiological state of these muscles. One has either to depend entirely upon the patient's none too reliable description or upon equally unreliable crude methods of examination. The beneficial effect is transient and neglible if not combined with suggestive influences or other psychotherapeutic procedures. One often forgets that the functions of the skin are little known and that undesirable reactions, especially erotic stimulation, may readily occur although they are not easily detected. In any psychiatric disorder, massage ought to be prescribed and supervised by the physician who knows the patient intimately and can predict the personality reactions to this therapeutic procedure. This implies that the psychiatrist should understand massage as well as other types of physiotherapy.

Little can be said in favor of gymnastic exercises except when they are included in a broader plan of physical recreation. Postural exercises are indicated only when a physical cause is present. Ordinarily, it is sufficient to offer advice with regard to posture in connection with callisthenics and in general recreational activities. Whatever one plans, the recreational procedures which are popular at the time should be utilized. It should always be remembered that physical recreation which affects the whole body, and not attention to special muscle groups, is important. The physiotherapist should be acquainted with the changes in physical recreation which are occurring at all times thereby being a practical guide to the psychiatrist. Without this assistance, the physician is forced to depend upon his haphazard knowledge which he obtains from more or less casual contact with schools and athletic clubs.

The value of physical and other types of recreation is considerable. One should not consider physical activity, as such, the essential factor, but rather the opportunity to enjoy muscular activity and to participate in games. Fatigue caused by emotional strain usually is relieved by enjoyable physical activities; fatigue caused by physical exertion is alleviated primarily by physical rest. This principle is utilized in our daily life by the sensible use of recreation and rest. In many chronic physical disabilities, physicians advise the well-planned use of rest and activity in preference to the avoidance of physical activity. The latter may lead to overconcern and anxiety which may cause more harm than a reasonable amount of exercise. In psychiatric disorders, physical recreation, balanced with rest, should be considered important in every patient. Physical recreation allows a patient to become part of a group in an easy way and to share with others. It offers the patient opportunities to try himself out, to learn to obtain pleasure from his success and to check a too far-reaching ambition, to stand failure without undue discouragement and sense of frustration. The same applies to all kinds of occupational and recreational facilities.

In a hospital with limited facilities, much can be achieved by a courageous worker who has the imagination to see and the initiative to create opportunities which others have failed to recognize. The best physiotherapy is not always done in beautiful buildings which are reserved for this purpose, but in places where an atmosphere which allows a patient to use his abilities for spontaneity has been developed. This can be done in large and small institutions, in convalescent homes, and outside of hospitals for those patients who are able to take care of themselves and to lead an active life.

An active therapeutic program is possible only if the physiotherapist receives enough information from the psychiatrist to understand the individual patient. With this knowledge, he will know how to stimulate and encourage the patient, or how to make him recognize with increasing willingness his limitations without becoming discouraged or irritated. Without sufficient information, the physiotherapist must necessarily fumble and try to achieve results by the expensive and even disastrous method of trial and error.

Physiotherapist and psychiatrist, working in conjunction, should be able to broaden the usefulness of physiotherapy in psychiatric treatment within and outside of psychiatric hospitals. The value of physiotherapy in the field of psychiatry is justifiably recognized in helping to abate motor and emotional excitement and in stimulating in states of underactivity. However, its importance goes far beyond this limited field. Physiother-

apy should play an increasingly beneficial role in combatting many complaints of physically ill patients and of persons in a more or less active life. In the well and in the sick personality, the same principles must be considered—individual balance of work and rest, reasonable attention to bodily needs and sufficient amount of recreation. An intensive study of recreation must include the individual differences for needs along physical lines, social contacts, and aesthetic gratifications. The wider utilizations of physiotherapy, as outlined in this discussion, are increasingly recognized. A sound progress can be expected confidently with further knowledge of physiology, psychobiology, and medicine, offering the physiotherapist wider opportunities for activities, guided by scientifically well-established indications and contraindications.

Short Wave Therapy in the Pelvis

John R. Evans, M. D.

To be orthodox, any paper should begin with the lengthy historical review. Fortunately the historicity of this mode of therapy is short lived and I am saved from padding this article unnecessarily. There is undoubtedly a vast literature on the subject, but in this short article I am merely going to give a few observations of my own which seem to me to have practical implications.

Heat, of course, as a therapeutic measure has been used from the time "when the memory of man runneth not to the contrary." All primitive peoples used heat in some form for the alleviation of painful afflictions. They used heat locally as hot fomentations and for its general effect in the form of sweat baths. This was done empirically and without theory by them, and empirically but with theory by us. Ever since Darst and Voll applied high frequency current to the treatment of human disease, we have been bombarded by the literature and the salesmen with reports of various electrotherapies. It has been interesting to note that most of the original work has been done from the physical point of view by the physical therapist. In so doing we have arrived at general indications for electrotherapy but have neglected some specific points which I will attempt to bring out.

As to mechanism, there seems to be a general agreement as to the heat production. Short wave therapy, as opposed to conventional diathermy, seems to produce heat by two different methods which probably accounts for its greater efficacy. In the first place it produces heat by virtue of tissue resistance. In the second place it produces heat because of its impedence, it being an electromagnetic current, the dielectric constant of the various tissues is as important as the actual resistance of those tissues. This is, of course, a far cry from the ancient institution, the hot stupe. It has been thought that its chief effect was in reducing pain by relaxing external muscle spasm, although there might have been some effect produced by reflex hyperemia.

As to the details of the heat effect in the pelvis, let us theorize for just a moment. In the first place, there may be an increase in the active congestion of the diseased area, either by increase in arterial flow or the relaxation of venous and lymphatic channels, thus allowing better drainage. Secondly, there may be a direct effect on the blood. This may be manifested in increased leucocytosis, in increased activity and increased digestive capacity of the leucocytes, or by the speeding up of antibody production. Thirdly, there may be a direct effect on the organism causing the disease either in attenuation or actual death by elevating the temperature above the thermal death point of the organism. However it be,

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the total effect is the sum of these mentioned and probably more.

As to treatment and results, rather than try to discuss the whole field of gynecologic infections, let us consider only a few of the commonly seen infections. The first one is gonorrheal salpingitis. These cases fall into two classes—those in which there is apparent cure and those in which only palliation is obtained. The term "apparent cure" is used because myself or some colleague may some day invade these pelves and find the same old telltale signs of the disease. Apparent cure is considered as freedom from pain, no tenderness on movement of the structures, no palpable masses, no fever or leucocytosis and no detectable fixation. The only cases, in my experience, in which there has been apparent cure are the acute cases. One seemingly important qualification is that treatment must be started early in the course of the disease and by that I mean at least in the first forty-eight hours. All of us who have opened these abdomens by mistake know that the first stage of the disease is an exudative stage. The tubes are swollen and red, but no abscesses are yet apparent and the fimbriated ends are still patent. The pelvis is filled with a straw-colored fluid and what deposits are visible are fibrinous rather than fibrous. While the material is still in the fibrinous stage, the enzymes which seem to be produced by the polymorphonuclear cells are capable, under stimulation, of preventing the progression to the fibrous stage. Another important qualification is that the structures must have been, prior to the onset of the disease, in normal position. Apparently in cases of preexisting malposition, particularly retroversion, adhesions are formed earlier, abscesses of the tubes form more readily and there is enough disturbance of circulation to prevent some of the effects mentioned above.

Those cases in which we can expect only palliation and perhaps a shortening in the course of the disease but with the ultimate pathology still present in greater or lesser extent, are: first, acute cases treated late after fibrous deposits have begun and the tubes are veritable abscesses; second, those with malposition as mentioned above; and third, recurrent salpingitis. In regard to cases of recurrent salpingitis in which surgery is being considered, there is a great deal of value in preoperative treatment. In the cases in which surgery is to be done merely to relieve the mechanical distress caused by adhesions and fixation, there is little to be gained. But in the cases in which there are recurrences of infection with all the signs of infection, there is marked benefit. Many of the small abscesses are absorbed and those remaining tend to be relatively sterile.

The second group of infections includes the postabortional infections. These are of two kinds, generally speaking: the pyogenic and the septic. The pyogenic infections, of course, tend to localize and many times good results are obtained with short wave therapy with a reduction in the incidence of cul-de-sac abscesses. In most septic postabortional infections there are some infected remains of the secundines within the uterus acting as a source of infection. Where the parametrial tissues do seem to be uninvolved, curettage is a safe immediate procedure. But where there is a definite parametritis, a course of short wave treatment seems to render curettage a safer procedure than it formerly was in these cases. In such cases immediate emptying of the uterus generally was followed by a swift septic course ending in death. Even the policy of watchful waiting seldom changed the ultimate result since little immunity seemed to be developed to the organism. While the somewhat marked lowering of mortality by preoperative use of the short wave cannot be explained, it is suspected that the benefit derived was from attenuation of the organism or a stimulation of local defenses. On the other hand, a few cases of septic endometrial ulcers or septic abscesses of the myometrium following either abortion or delivery, have been seen in which the short wave apparently had no effect whatsoever.

CONCLUSIONS

Short wave therapy in the pelvis seems to produce apparent cures in acute gonorrheal salpingitis if treatment is instituted early and there was no preexisting malposition, and also in some of the pyogenic postabortal infections. It is of value in palliation or in shortening the course of the disease in acute gonorrheal salpingitis treated late or complicated by malposition. It is of benefit preoperatively in chronic pelvic infections and in septic postabortal infections.

Spastic Paralysis

Rutherford L. John, M. D.

Spastic paralysis, the cerebral paralysis of children, sometimes called Little's disease, is second only to anterior poliomyelitis in frequency and importance. The concurrent cerebral symptoms make it a much more difficult problem. The disease is characterized by weakness, rigidity, and loss of control of the muscles, at times with athetoid movements, particularly of the arms. Athetoid movements are more or less constant involuntary contractions of successive muscles. These purposeless contractions become superimposed upon voluntary movements and result in marked incoordination. When severe they reduce the patient to a pitiable state, indeed.

Spastic paralysis is due to injury or disease of the cortical or basilar portions of the brain. It may be congenital or acquired, the modern feeling being that the condition is not nearly so often due to injury at birth as was formerly supposed. Mental deficiency, varying from emotional instability to idiocy, always is present. As may well be understood, the mental symptoms vary with the severity of the motor symptoms and are usually less in the hemiplegic form of the disease, as in these cases only one side of the brain is affected. One or more extremities may be involved. If only one, the disease is called monoplegia; if one-half of the body is paralyzed, it is hemiplegia; if both legs, it is paraplegia; if both arms and legs, diplegia or quadriplegia. As a result of the upper neuron lesion there is a removal of cerebral inhibition, causing greatly exaggerated muscle tonus, increased reflexes, and a condition of hypertonicity in the affected parts, with resulting paralysis.

It is to be remembered that paralysis is the loss of motion or sensation in a part. This loss of motion may be due to inability of the muscle to contract, as in the flaccid paralysis resulting from infantile paralysis, or an inability of the muscle to relax, as is the case in the condition of spastic paralysis.

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Before attempting any form of treatment, certain physiological facts should be recalled. The flexor groups of muscles are always stronger than the extensors; the adductors, than the abductors, and the internal rotators are stronger than the external rotators. These facts largely account for the typical deformities of the limbs in the disease. If the lower extremity be involved, for example, the hip and the knee will be flexed, the limb internally rotated and adducted and the foot drawn into a position of equino-varus. If both lower limbs are affected there results the typical scissor gait. It is to be remembered that while in general the deformities are due to the above physiological facts, the hypertonicity of certain groups of muscles also may be responsible for the production of deformities. All muscles of an affected part are not in the same state of spasm, some muscle groups showing actual flaccid weakness on careful analysis. Also, it must be borne in mind, that after years of such deformities, the weaker groups are overstretched and further weakened, and the contracted groups actually may shorten. This latter condition is not so often true as is generally supposed. A contraction is a temporary shortening of a muscle; a contracture is a permanent shortening. In spastic paralysis the shortening is, in most cases, a contraction, and when the irritation of the upper motor neuron is relieved, as in sleep or under anesthesia, the deformities disappear. An operation to lengthen such a contracted muscle may well result in the production of the opposite deformity. For instance, an equino-varus may be converted into a calcaneo-valgus. The typical deformities are the result of the pull of the stronger groups. If these stronger groups are weakened by too much lengthening, the opposing groups will contract to cause the opposite deformity, or, at least, to further weaken the part. As stated above, the contracted groups actually may shorten after years, but since the spasm is more or less relieved daily in sleep and relaxation, this occurs much less frequently than one might suppose.

The treatment of spastic paralysis consists of splinting, operations and physical therapy. Of these, physical therapy is by far the most important and the most effective. Any other form of treatment is only to render the results of physical therapy more effective.

Splinting or bracing of a part has two advantages. In the lower extremity when the muscle spasm is so severe that the patient is unable to stand, proper braces will hold the parts in alignment and enable the child to learn to stand and walk. The constant stretching of the contracted groups by a brace and the relief of overstretching of the weaker groups will tend to ease spasm and prevent possible contractures, thus allowing coordinated movements to be taught.

Operations in these cases are done to diminish muscle spasm, to equalize power of opposing muscle groups and to correct deformities by myotomies, tenotomies, tendon lengthenings or transplantings, and are performed on bones, muscles, tendons and nerves. Bone operations usually are done for the purpose of stabilization, as a substragalar arthrodesis in a persistent varus or valgus deformity of the foot. Operations on the muscles and tendons are an attempt to relieve contractures or to equalize muscle pull. Where true contractures are present, such operations are most helpful, but it always must be borne in mind that when all the muscles are spastic, to change the muscle imbalance from one group to its opposite result only in causing the opposite deformity.

Nerve operations have been of various types. Cerebral decompression was advocated by Sharp and done by him in 236 cases. But as local operations and physical therapy measures also were carried out, the advantages of so serious an operation are questionable and to me personally do not seem to reach the source of the trouble. Forster, in 1907, began section of the posterior nerve roots, after exposing the dura of the cord by a laminectomy. The operation is an extremely severe one, and these cases do not stand shock well. The results apparently are no better than in the simpler operations. We must remember that we cannot hope for a cure from any operation. At best the results will only facilitate the improvement to be gained from physical therapy.

In 1911 Stoffel conceived the idea of breaking the reflex arc on the motor side by resecting portions of the motor nerves. The idea, of course, is an attempt to restore muscle balance by an excision of a part of those nerve fibers supplying the more strongly contracting muscles. Stoffel recalled that a nerve trunk is composed of nerve fibers which establish a direct communication from the nerve cell to the individual muscle bundle. Theoretically, the spasm of the muscles of the upper extremity should be relieved by this operation quite as well as that of the lower, but practically, the results in the arm have not been so satisfactory and nerve resection in the upper extremity has largely been abandoned. This failure has been due to the finer movements necessary for coordination of the fingers and hand. Where grosser muscle groups are in spasm, nerve resection is most successful, but the innervation of the muscles of the hand is so divided and complicated that we are unable to obtain very successful results by nerve resection. The scissor gait, caused by the spasm of the adductor groups in the legs, may be relieved by an excision of a portion of the anterior and possibly the posterior branch of the obturator nerve. The very deforming equinus or equino-varus may be relieved by a resection of a portion of the internal popliteal nerve.

I wish to reiterate that any procedure, operative or otherwise, is only an adjunct to physical therapy. The treatment must be of years' duration and always requires infinite patience. The improvement obtained depends largely upon the degree of intelligence of the patient. In the idiotic or feeble-minded the results are most discouraging, in the higher forms of mentality, surprising results can be obtained with persistent training.

We accept the physical development of the normal child as granted and concentrate in our schools on his mental growth. In these spastic cases we must develop the physical along with the mental growth, not expecting too rapid a physical response from an abnormally retarded brain. As Doctor Phelps says, "The gait of a child and his emotional behavior are apparently not very closely related but in making him a normal human being one is as important as the other." The child which has not developed sufficient mentality to coordinate, cannot be expected to respond physically to efforts to make his muscles obey his volition.

Many of these cases are affected as to their speech. Early training in speech should be instituted. Indeed, orthopedic care, physical

therapy, speech training and mental training must work together and at the same developmental level to give the maximum results.

There are really two types of spastic cases. Those due to cortical injury have a predominance of spastic symptoms, the basilar type show more athetosis. These types are less rarely mixed than is commonly supposed, although without careful muscle study it is often extremely difficult to differentiate between them. The athetoid cases, with their recurrent involuntary contractions, particularly apparent when an effort at voluntary motion is attempted, soon learn to hold the part rigid before an effort at voluntary motion is made in a vain struggle to control the involuntary contractions. This rigidity soon becomes a habit and only after teaching relaxation will it be discovered that the muscle is not spastic in itself.

In the cortical type, the spasticity rarely is found evenly distributed in a limb. Some muscle groups may be fairly normal and others actually show a flaccid weakness. These two latter groups, of course, suffer at the expense of the hypertonic groups, with resultant deformities. From the physical training standpoint, one can easily realize how much we may do in the way of development of these nonspastic muscles after obtaining relaxation of the spastic groups.

Massage in spastic paralysis is in general contraindicated. Massage is used in physical therapy to prevent atrophy and to increase muscle tone. Muscular atrophy in these cases is not a conspicuous defect and there is already present a hypertonicity of the muscles. Unless the mildest form of effleurage is given, and given by an expert, in an effort to gain relaxation, there is no indication for the use of massage.

Relaxation is essential before any form of treatment is instituted. The patient should lie down in a quiet room for at least ten minutes before treatment is started and should be taught to relax. Hot baths at a temperature of 102 F. are helpful in securing relaxation. In the last few years very encouraging results have been obtained in giving coordination exercises while the patient is in a hot bath or pool. When relaxation has been secured the grosser movements of the affected extremity should be taught before any finer coordinated movements are attempted. For this purpose, sling exercises with attached weights are helpful as a method of developing a sense of rhythm. An extremity supported in a sling with an attached weight is started swinging, giving a pendulum action which the patient is encouraged to continue in a rhythmic manner. Movements done to the timing of a metronome or to music, or to the cadence of a drill, all help in establishing coordination.

Exercises, preferably before mirrors and with both arms or both legs performing the same movements, are helpful. Standing exercises, with the head held high and with proper body balance will teach balance. Walking along a narrow strip of carpet or between two white lines is of assistance in training a child to walk slowly and correctly. Whatever the exercise, it should be done slowly and every effort made to have it done correctly before passing on to the next. It is very difficult to attract and to hold the attention of these cases and all orders should be given in a sharp, clear tone, and the operator must insist that each order be carried out. Fatigue, both physical and mental, appears early and instruction periods should not last too long but should be as frequent as possible. Impatience or an attempt to hurry the patient on the part of the operator is fatal to success.

In conclusion, let me again emphasize that any form of treatment, operative or otherwise, is only an adjunct to physical therapy in the treatment of spastic paralysis. Of the various forms of operative interference, Stoffel's nerve resection seems to give the most promising results when done on a suitable case. When improvement once starts, it is not only progressive but surprisingly widespread. The relief of the spasm contraction in one extremity apparently affects favorably the spastic condition of other groups in other extremities, permitting readier relaxation. Even an improvement in the mental condition has been noted.

Massage as a rule is contraindicated. Attention should be focused on obtaining relaxation, followed by coordination exercises. Under such treatment improvement is possible in all but the worse cases. Where the mentality is not greatly impaired the results at times have been astonishingly satisfactory.

The Chronically Disabled Hip

Edward T. Evans, M.D., F.A.C.S.

The problem of the chronically disabled hip in the adult naturally falls into four etiological groups:

1. Results of congenital subluxation or dislocation.
2. Results of developmental changes.
3. The arthritic hip, morbus coxae senilis, and the end result of aseptic necrosis.
4. The traumatic hip, notably nonunion fracture of the neck of the femur.

Inasmuch as this is a discussion of adult conditions, I believe we will find fewer untreated congenital dislocations of the hip in the future. There are, however, certain end results even of well treated congenital dislocations of the hip which in later life cause disturbances. Actually it is probable that these poor end results represent developmental changes as a result of interference of circulation of the head of the femur with the resultant malformation and secondary static or "traumatic" arthritis. There is another group of cases upon which attention has more recently been focused; namely, shallow acetabulae and congenital subluxation of the hip unrecognized until adult life when, as a result of the poor mechanics of the hip, secondary arthritic changes occur associated in some instances with "traveling acetabulum." These end results often are indistinguishable from morbus coxae senilis. Observation of some of these cases over a period of twenty or thirty years with serial x-rays has demonstrated the etiological significance of the congenitally maldeveloped acetabulum.

The largest group of painful hips in the adult undoubtedly are the result of arthritis, either infectious or hypertrophic. The difficulties arising in the infectious arthritis case are in many instances due to improper treatment at the initial infection or failure of the patient to persist in outlined treatment, thus allowing deformities to occur which as an end result necessarily must cause great disability. Morbus coxae senilis may be indistinguishable from infectious arthritis from an x-ray standpoint but it is felt that it is frequently a result of metabolic changes occurring in early adult life precipitated by initial or repeated trauma with secondary circulatory changes. In this respect it is somewhat akin to aseptic necrosis though aseptic necrosis has come to be associated with a relatively sudden circulatory change with secondary necrotic softening and fragmentation of bone of the head of the femur with late consolidation resulting in deformity inherent to the head of the femur.

All of the above conditions with the exception of frank dislocation of the head of the femur leave the fulcrum intact, and instability is a result of altered mechanical leverage.

In the nonunion fracture of the neck of the femur an entirely different condition is met with as a cause of the resultant disability. In this instance the fulcrum is lost so that muscles otherwise capable of carrying on their work have lost their leverage; instability is the major disability unless pain supervenes. The same principles operate in frank dislocation of the hip.

With the exception of the unstable hip as represented by the congenital dislocation and the nonunion fracture of the neck of the femur, the problem of treatment of the disabled hip is largely one of mechanical restoration of proper functional weight bearing irrespective of etiology. Cases amenable to physical therapy and other conservative methods of treatment will not be considered.

There are two schools of thought regarding the essentials of treatment of this type of case. The one school feels that every effort should be made to preserve functional mobility. The other school feels that functional mobility may be sacrificed to functional stability. The one school advocates arthroplasty and the other school arthrodesis.

As a matter of fact it would seem that in the judicious application of the former, it is obvious that stability is necessarily the aim of treatment and where the joint proper is

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undisturbed or capable of carrying on function, treatment should be directed toward preserving motion while stability is attained.

The Adult Congenital Dislocation

Frank dislocation: In this type of case treatment has been unsuccessful or neglected in the past or has been inadvisable due to insurmountable circumstances or the age of the patient. Any of these patients, if trained in a sedentary existence, manage quite well but others eventually develop pain and discomfort secondary to their instability. It is a well known fact that many of these cases have developed a real deformity due to shortening, flexion and adduction. Many procedures are at hand to offer them stability. Simple shelving above the misplaced head of the femur will stabilize a few of these it is true, but in others the deformity is such that even with shelving, the flexion and adduction with loss of gluteal leverage cause persistence of disability. For these, either primarily or as an operative procedure secondary to shelving, two methods of treatment are available. The Lorenz bifurcation operation converts the proximal portion of the shaft of the femur into a sort of short-armed "y" with the proximal end of the distal fragment of the femur lying against the acetabulum and united to the proximal fragment of the femur. Inasmuch as the muscular control of the fragments is not disturbed, active motion with weight bearing against the side of the pelvis is an end result. The procedure, however, frequently results in slight shortening over and above that already present. Observation of these cases over a period of years shows that the proximal end of the distal fragment frequently absorbs so that the actual end result is merely angulation of the shaft of the femur at about the acetabular level. As a matter of fact this late end result of the Lorenz bifurcation is the actual early result of the Schanz osteotomy. This osteotomy is performed with the same indications as the bifurcation procedure and results in weight bearing against the side of the pelvis with the leg in functional position. This thrust of the weight bearing against the pelvis gives stability. As stated above this procedure may be combined with the shelving operation in order to restore proper weight bearing by correcting flexion adduction deformity.

Arthritis of the altered hip joint per se will naturally fall into two categories; namely, partial ankylosis with or without deformity and complete ankylosis. No operative procedure should be attempted during the acute stage of infectious arthritis. It should be postponed until the acute or subacute condition has "died out." In cases of partial ankylosis, pain is frequently the major factor. This pain may be intrinsic to the joint itself in which case one should be most careful to exclude the possibility that activity is still present. However, it may be and usually is due to the deformity assumed and is reflected in static strain of the capsule or the gluteal muscles which necessarily bear the brunt of functional use. By simple conversion of the deformity into proper weight bearing position, pain may be relieved and stability increased. Naturally the simplest procedure is high osteotomy, the so-called intratrochanteric or high subtrochanteric osteotomy. If deformity is the only factor with painless motion otherwise present, McMurray osteotomy may be utilized to advantage. This is an oblique osteotomy through the intertrochanteric region in which the proximal end of the shaft of the femur is displaced inward rather directly below the acetabulum thus bringing the shaft of the femur in functional weight bearing position.

This type of case also may be well treated when the active process is "burned out" by arthroplasty. A careful analysis of the results of arthroplasty in the past several years has led many men to discouragement. However, recent advances in the use of the vitallium cup placed between the remodeled head of the femur and the acetabulum are encouraging. Many types of interposed tissue or membranes have been used with varying degrees of success.

If pain is a predominant factor and if there is associated therewith a great deal of active change in the point or if mechanical conditions argue against the use of any of the above procedures, arthrodesis in functional position will stabilize the joint end and, if successful, stop pain. Unfortunately many attempts at arthrodesis in the adult meet with partial or complete failure no matter how thoroughly or carefully nor by what technic the procedure is carried out. Recently it has been advocated that a long Smith-Peterson nail be inserted from the trochanteric region through the neck and head of the femur across into the acetabular portion of the pelvis, thus thoroughly anchoring the hip in the desired position.

NONUNION FRACTURE OF THE NECK OF THE FEMUR

The problem here resolves itself into production of stability. This may be accomplished in one of several ways. If the head of the femur is viable and there has not been too much absorption of the neck of the femur an attempt at freshening the fractured surfaces with subsequent nailing or bone graft might be considered. Unfortunately the very factors inherent to the development of nonunion still operate. In these late cases union would not appear to be probable as an end result. Besides this, extremely long confinement is added to the already prolonged total disability of the individual.

If the muscular structures surrounding the hip are in good condition and the joint itself has not suffered as a result of aseptic necrosis or circulatory change, McMurray osteotomy offers stability as an end result in many cases followed by union of the fracture site. This is a relatively new procedure which has been received with considerable enthusiasm because its technic is simple, the resulting convalescence is short and in most cases painless functional stability is the end result.

The Whitman reconstruction operation offers much in that it usually results in stability though there may be varying degrees of painful function and there invariably is some shortening. The Collona procedure also has its advocates. Stability, when successfully performed, is excellent; there is practically no shortening and there is much less likelihood of painful limitation of motion. It carries with it, however, the danger of early or late dislocation and resulting instability. Arthrodesis is almost never necessary.

SUMMARY

1. The major complaints of disability in the adult hip are outlined.

2. The newer and more accepted modes of treatment are discussed briefly.

Common Traumatic Conditions of the Extremities

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In the field of sports, in industry, following automobile accidents, in fact in all walks of life the orthopedic surgeon is called upon to care for injuries to the extremities, particularly the type involving joints. Inasmuch as the restoration of function depends a great deal upon physical therapy especially in the convalescent stage of these conditions, a presentation of a few of the more common injuries should be interesting and instructive.

The consideration of the elementary phase of any subject is quite important. Therefore, some very primary principles will be incorporated in this article. What is trauma or injury? We include all injuries under wounds, and we define a wound as the loss of continuity of the surface of the tissues, either internal or external. Tissues, as you know, are groups of cells organized for a specific function such as muscles, skin, bones or tendons. In orthopedic surgery we are interested in the bones and joints and their allied structures, particularly the restoration of the structure and function of diseased or deformed tissues to as nearly normal condition as possible. Many of us, from the layman to the well trained surgeon, are interested in the results of treatment only, which probably is fortunate so far as the patient is concerned, but in the aggregate is unfortunate for the progress of science. And in order to obtain the results that we desire, though it may be drudgery, it is necessary to familiarize ourselves with the anatomy, the physiology and the process of healing which takes place following trauma.

What, then, are the tissues with which we

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are dealing? First, the bony or the skeletal structure which furnishes the body with proper support or rigidity assisting materially in maintaining the normal shape or contour of the body. At the junction or union of the bones are joints; a joint is a junction of one or more bones held together with ligaments, muscles and tendons for the purpose of motion. The ends of the bones being lined with a smooth tissue called hyaline cartilage to permit of a gliding or free motion, and, if I may so call it, the oiling process is carried on by a special membrane known as the synovial membrane which secrets a fluid very much like the serum of the blood and which is known as the synovial fluid. The ligaments themselves merely hold the bones together and prevent abnormal dislocation or slipping of the bones one on the other. The muscle and tendon tissues which have the power of elasticity, contractility and strength produce the power of motion. I am certain that most of you are familiar with these different groups of muscles. They in turn are served by the nerves which, in addition to the motor nerves supplying the proper stimulation to the muscles, also carry back to the central nervous system the different sensations of pain, touch, heat, cold and so forth. And finally the blood and lymph with their vessels which give the proper nutrition to these other tissues; and covering the entire body is the soft tissue and skin, one of the major functions of which is to protect the body against the invasion of undesirable foes. All of these tissues naturally have a much broader and wider function than can be discussed in this article. But, briefly, we have a mechanical apparatus—the human body—consisting of many groups of organized cells all working together in very proper and complete unison with perfect correlation and cooperation, primarily so far as we are concerned to give the human body the important phase of locomotion, the power to execute movement, coordinated functions such as writing, painting, needle work, throwing a ball with the upper extremities, and in the lower extremities standing, walking, running, jumping or propelling some machine—here again for the purpose of locomotion.

In traumatic injuries to these parts the body is deprived of many of the useful movements, and our purpose in traumatic surgery is to restore these parts as nearly as possible to normal, both as to the structure and as to the function. We must realize at all times that we can only repair, we can only assist nature in regenerating, and unfortunately cannot replace the parts. Therefore, most of the time we are working under a considerable handicap.

What, then, are some of these common wounds that we see in the extremities, their cause, their symptoms and their treatment? As previously stated we define a wound as a condition in the tissues in which there has been a loss of continuity of the surface, either internal or external. We have several fundamental or primary wounds, such as abrasion, which is a tearing of the superficial layers of the skin; laceration, which is a tearing and bruising of all the layers of the skin; incision, which is a cutting wound; puncture wound, contusion, which is a bruising of the tissues, fractures, fracture dislocations, sprains, strains and a combination of these, all of which, it is assumed, have been produced by some force, usually physical. The most serious of these are usually considered the fractures and the fracture dislocations, invariably accompanied by soft tissue trauma. In a discourse of these different wounds, we routinely consider the definition, the etiology or the cause, the changes that take place in the tissues or the pathology, the symptoms and finally the treatment. The cause of these conditions is due to some external force. Unfortunately we see a great many of them in automobile accidents where the force is very irregular, and in too many cases so severe that the body is mutilated beyond repair. Other common forces are seen in industrial work, such as the falling of a rock on a part of the body; or the falling of the body some distance, as down a mine shaft; or a force which has brought in contact two bodies, as in a football game; in the household a fall from a chair or a step ladder, a fall onto an extended forearm. The actual process which is caused is a tearing of the tissues themselves, a tearing of the blood vessels with extravasation of blood into the spaces, or the breaking of the bone tissue with a resultant hemorrhage around the fragments or into or around a joint. The reaction of the body to the injury of the tissues produces the symptoms. In the incised and lacerated wound we find, in addition to the tearing of the skin, pain, which is the common and important symptom, external hemorrhage, swelling, dis-

coloration, black and blueness (ecchymosis), tenderness, and, in a fracture, the unnatural motion, the grating of the bones which is called "crepitus," the deformity of the extremities usually with some shortening, inability of the patient to use that part, a temporary paralysis of the muscles, and along with this we include the findings with special apparatus, that is, the x-ray showing the actual change in the bony structure. In all severe or suspected injury to the bony structure we insist upon an x-ray including views taken at different angles. And fortunately since the x-ray has come into such common usage and is so efficient, we usually can make a positive diagnosis. So when these patients come to us with their injuries, they have come for a definite purpose. They have come to us for relief of pain and for the restoration of function and a restoration, too, of the structures to as nearly normal relationship as possible. Therefore, to the patient the treatment is the important thing. For the prevention of infections in the wound and to assure healing as rapidly as possible where there has been a breaking of the skin, it is necessary to clean the wound, both mechanically and chemically using green soap and water, ether and alcohol, to excise or remove the devitalized tissue and to suture the viable tissues or parts into as near a normal relationship as possible. When we consider the different antiseptics that are used, from the iodine, mercurochrome, mercressin, to the weak boric acid and epsom salts solutions, sarcastically, it often has been called "chromatic" surgery instead of "traumatic" surgery. We have found that the all important thing in the treatment of wounds is the good mechanical cleansing with the removal of the devitalized tissues. In all wounds where there has been a breaking or a tearing of the tissue of any severity at all, the routine method is to administer prophylactic dosage of tetnus and gas serum which is found not to be completely preventive for these two conditions, but certainly in the majority of cases it is a very satisfactory prophylactic procedure. Very often the restoration of these tissues to their proper position and relationship is very simple; however, at other times it is very difficult especially where there has been so much devitalization of the tissue itself. In these cases it is often necessary to transplant similar tissues from other parts of the body, and in many cases, too often perhaps, the result is far from entirely satisfactory and we get a disfigurement or a deformity so severe that it may lead to amputation. However, for the most part, let us consider fractures, fracture dislocations and joint injuries. We consider fractures, breaks and cracks of a bone as synonymous terms, differentiating between the different types of fractures with terms such as these: transverse fractures, oblique fractures, spiral oblique fractures, comminuted fractures and, of course, the primary classification is the simple and the compound. The simple is that type of fracture in which the skin has not been broken through, and the compound is just the opposite—where there has been a breaking of the skin, a connection so to speak between the bone and the outside world; an easy avenue of approach for infection. In auto accidents this little poem describes the problem from the etiological standpoint very well:

"A lad, a lass, a car of class,
Two hearts so full of rapture;
A miss, quite rash,
A kiss—a crash
And a possible 200 fractures!"

Briefly I have given the symptoms of fractures. I want now to consider the treatment of a very common and often serious fracture which I think will typify the routine treatment in most fractures; that is, a fracture of the elbow joint in a youngster in which there has been some joint involvement—common so-called dicondylar fracture; secondly, a common joint injury in which there has been no fracture such as the so-called football knee, where the trauma has been essentially to the cartilage of the joint. The first stage in any fracture is the emergency treatment. The second, the stage of reduction or the restoration of the parts to proper position—so-called "setting" of the fracture. Third, the retention of these parts by splints or casts to maintain the position, and, finally, the restoration of function. The last three are classically known as the three "R's." The first procedure, the emergency treatment, usually is carried on in the ambulance or by the police surgeon or first aid man at the site of accident. It is for the purpose of bandaging and supporting the tissues, the relief of pain, the prevention of hemorrhage. In other words the execution of certain procedures which will support the patient's life and protect the injured tissues until proper and more exacting

procedures can be carried out in an institution. The important thing in emergency treatment is not to traumatize the tissue further by unnecessary handling and manipulation. During the war the axiom was "splint them where they lay"—no effort was made to reduce the fracture on the battle field. The second procedure is the reduction of fractures. Fractures are emergency cases and should be reduced early, but a simple fracture of the extremity should not be treated until the patient's general condition will permit. We do not set a bone when the patient is in shock. In the reduction of fractures we usually use an anesthetic, either local, general or spinal. In multiple fractures of one individual it probably is better to use a general anesthetic as better relaxation can be obtained. With or without the use of a flouroscope, and by manual manipulation, known as the closed method, we then attempt to restore the fragments to normal position. After they are placed in the proper position or as near normal as possible, we then apply the third principle and that is the one of retention. Plaster paris bandages made into casts or splints are used probably more than any other type at present. However, aluminum, wire and wood splints are used a great deal and are very efficacious in maintaining position—each surgeon to his own choice. In the last quarter of a century, for the purpose of procuring and maintaining position of fragments, skeletal traction has come into use and is very valuable. That is, a traction or a pull on the fragments, which is maintained by apparatus extending into the bones themselves, usually somewhat away from the site of fracture, and maintaining a constant pull on the fracture. Particularly are they used in fractures of the shaft of the bone where there is an obliquity of the fragment, and where a constant, uniform pull is necessary for a period of several weeks or even months. If we cannot get a good position by the so-called closed or manual reduction, we then rely on open reduction, which usually is done a few days following the injury as danger of infection is much less than if done immediately. The fragments are placed in proper position with instruments and held by internal fixation of plates or grafts and by external fixation of splints or casts. Always following reduction a check x-ray is made to assure us of proper position, not only for our own information, but as a record so that in case there might be litigation, proof of proper treatment can be given to a none too favorable jury.

Following the proper reduction and the proper immobilization the next question is how long should a fracture be kept at rest or how long should it be immobilized. This will depend a great deal upon the age of the individual, upon the site of the fracture in the body—whether it is near a joint or not. The younger the individual the quicker union takes place, and the nearer a joint the quicker motion should be started. According to Böhler's theory and practice in the treatment of fracture very early motion and very early function of the tissues should be encouraged. As soon as he has properly immobilized certain fractures, particularly of the lower extremities, he encourages function. He puts on a cast which is strong enough to permit of walking and advises the patient to begin weight bearing within a short time—sometimes as early as twenty-four hours. Some of his ideas are good. Undoubtedly there is some contraindication to too early use of tissues as physiologically it is not sound to overuse or overstretch the tissues which have recently been traumatized. The average fracture, say of the forearm of a child, will show good union in about four to six weeks. This period of healing may extend in the aged to as long as eight or twelve months. If at the end of six months there is no union at all, either clinically or on x-ray, we feel that it should be considered a nonunion and operative interference should be instituted a little later.

Let us consider a specific case—that is, a fracture near the elbow joint in a child ten years of age. This is usually caused by a fall onto the arm. After proper reduction, which is done under a general anesthetic with a definite routine procedure in the manipulation, the arm is then held in acute flexion as this will be the position of choice of that joint should there be any stiffness in the joint later. Following the application of the cast for immobilization—or whatever method we may use—it is very important to watch the circulation of the fingers. This is checked every few hours for if there is much interference, either with the venous or arterial circulation, a very serious condition may follow—a so-called ischemic paralysis. If there is no interference in the circulation, if there is no undue localized pain or tenderness and things pro-

gress as we think they should, the cast or support is left on for about ten days and is then removed partly for inspection. If the tenderness and pain are gone, if there is apparently some soft union taking place, then comes the question of restoration of function. We are assured by clinical examination that there will be no slipping of the fragments. Therefore, physical therapy is now indicated. What forms of physical therapy? Needless to say, you are all more familiar with this problem than I, but an opinion from an orthopedist will in most cases make you realize that the orthopedic profession does think quite highly of your specialty. I mean by physical therapy all types of physical methods of treatment; that is, heat—either thermo or electrical; massage—either manual or mechanical; hydrotherapy—the whirlpool or the large pool—the hot pool or the cold pool, each, as you have undoubtedly found used for a special purpose. In speaking of physical therapy and the physical therapist, it might be advisable to mention now the relationship of the surgeon and physical therapy. Occasionally in the past there has been considerable misunderstanding, or should I say misinstruction. I may want a thing a certain way—you are desirous of doing it that way, but because of our improper communications, we have not had the proper understanding about the case. I think it is wise that the surgeon should in all of these cases have a talk with the physical therapist so that the latter can understand what the surgeon desires. And in many cases the physical therapist can offer advice in the methods or the types of physical therapy which will be of considerable benefit to the surgeon. I may ask for massage—you can then tell me what type of massage will get what I want from a physiological standpoint. The better the understanding that we have, not only in general terms, but in specific cases, certainly the more efficiency we can expect in these specific cases. If I tell the patient one thing, and you tell the patient another thing it will not be long until that patient will be discouraged and will go elsewhere for both the surgical and the physical therapy treatment. And as we cannot promise too much in the treatment of these cases, so should it be in your case. We have this service to offer, but certainly we cannot promise definite results in any given case.

Now back to the elbow joint, again. At the end of ten days or thereabouts, the cast or part of it is removed. The patient is then instructed to use the joint actively, very little of course the first day—a few minutes. In addition to this active motion some form of heat, either dry or moist, is given, with a little superficial massage. The purpose is to get function as early as possible, to increase the circulation in the tissues without doing any undue trauma, such as breaking up adhesions and getting a secondary hemorrhage in or around the joint. As the swelling subsides and the tenderness lets up, as the flexibility and contractility of the tissues increase, then the force of the massage may be increased. The force of the active motion, and after a period of two or three weeks gentle stretching or manipulation of the joint may be instituted, not beyond, however, at any time the point where there is any pain or where there is danger of further trauma to that particular area—our one purpose being to get a regeneration of the tissues to as nearly normal a condition as possible; by increasing the circulation and by being careful at all times, particularly in fractures, to get adequate union of the bony tissues, and not to traumatize either the bone tissue or the soft tissue. As the strength increases, then the resistance offered in the treatment of manipulations or stretchings can be increased—very similar manner as is used in infantile paralysis cases. First, against gravity, then against the mild forces, and finally against considerable force. The exact amount comes only after years of experience in these cases, and I am sure most of you have acquired this. This form of treatment is continued until the patient has received the maximum improvement, that is, until there has been no noticeable improvement over the period of several weeks and sometimes even months. Never dismiss a patient until everything has been done that can possibly be done to get a better restoration of function. Many times there has been nerve injury, there has been vessel injury, it is necessary then to include physical therapy to the entire extremity to protect the weakened nerves, and to protect the weakened muscles and to restore the circulation more and more.

In many cases of severe injury to the joint there is no injury to the bony structures—only a cartilage injury. This is very common in knee injuries, particularly in the sport of football. In this case there has been an injury to one of the semilunar cartilage with either a breaking of it or a dislocation so that it causes an internal derangement of the joint

—the so-called locking or blocking in the knee joint. The immediate treatment is to immobilize, apply cold packs and often aspirate the bloody fluid. If, after a few days, it definitely is evident that the cartilage has been broken, the procedure is surgical. The joint is opened very carefully as in any major operation. A repair of the tissues is done, and usually a fractured internal semilunar cartilage is removed. After four or five days physical therapy is begun. Heat, gentle active motion, superficial or surface massage, and with care not to overstretch the tissues or further traumatize them until definitely good healing has taken place, particularly in the ligamental structures. This is kept up daily for a period of two or three weeks, and at the end of about four weeks the patient usually is able to walk with a fair range of motion, the total period of disability being from six to eight weeks.

The Orthopedic Management of Arthritis

Pierre J. Walker, M. D.

In no other disease have so many remedies been offered with such great initial enthusiasm and with such uniformly disappointing results as in the treatment of arthritis. The consequent skepticism as to the value of any treatment often unfortunately deprives the patient of adequate orthopedic care.

There can be no reasonable doubt of the importance of mechanical measures designed to control deformity and local physical therapy to maintain function in the affected joints. These are the main objects in the orthopedic treatment of arthritis.

The terminology of arthritis has been almost as complicated and confusing as the therapy. In order to simplify this, the following classification will be used: (1) acute arthritis; (2) chronic arthritis, (a) atrophic, and (b) hypertrophic; and (3) fibrositis.

ACUTE ARTHRITIS

These cases begin quite suddenly with severe pain, swelling, fever and leucocytosis. In the presence of this syndrome, it is of great importance that an accurate diagnosis be made without delay. In the first place we must rule out inflammation of the adjacent bone. Osteomyelitis near the end of a long bone may closely simulate arthritis and may be accompanied by joint effusion. This condition is differentiated in the early stage by the presence of localized bone tenderness and after about the tenth day by the presence of characteristic x-ray changes. Early drainage of such bone infection may be necessary to prevent destruction of the adjacent joint.

After establishing the diagnosis of arthritis, it is then of urgent importance to know whether we are dealing with an acute suppurative infection of the joint. This can be determined by early aspiration and by microscopic examination and culture of the joint contents. Suppurative arthritis demands early and free drainage before the pus has had time to undermine the articular cartilage.

If aspiration of the joint reveals a nonpurulent effusion, we must next inquire whether we are dealing with gonococcal arthritis. This sometimes can be determined by growth of the Neisserian diplococci from the joint fluid; but in the great majority of instances the diagnosis must rest upon the presence of gonococcal infection elsewhere in the body. The clinical history is here of consider-

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able assistance, in that gonorrheal arthritis characteristically begins as a migratory polyarthritis which settles after a few days in one of the large joints, all the other joints having cleared up completely. This disease can now be successfully treated either with sulfanilamide or with artificial fever. The success of the treatment depends in large measure upon an early diagnosis.

Rheumatic fever always must be thought of in acute arthritis, particularly in childhood and youth. This disease also begins usually as a migratory polyarthritis, but rarely, if ever, produces serious joint damage. It is usually alleviated promptly by salicylate therapy. Early diagnosis is important in order that proper medical measures may be taken to prevent serious damage to the heart.

Acute arthritis due to other specific organisms, particularly the streptococcus and the pneumococcus, may occur as metastatic lesions. These also are diagnosed by bacteriological study of the joint effusion and can be treated with specific serum, sulfanilamide or sulphpyridine.

In the treatment of acute arthritis, aside from the specific remedies enumerated above, there are a number of important therapeutic measures to be considered, aimed chiefly to relieve pain.

1. Aspiration. In addition to its diagnostic value, repeated aspiration may serve to relieve pain by diminishing intra-articular pressure.

2. Lavage. Repeatedly washing out the joint with large quantities of warm sterile salt solution is of value, particularly in cases with a heavy exudate.

3. Splinting. An acutely inflamed joint must be protected against motion and other painful stimuli. This can be accomplished best by application of a plaster cast. In some instances traction is preferable.

4. Heat usually affords a great deal of relief. It may be applied as radiant heat, diathermy or hot packs.

5. Cold applications sometimes give more relief than hot, especially if the inflammation is intense.

6. Local injections. Procaine solution 1 per cent injected into the vicinity of the joint capsule often gives considerable temporary relief and may serve to interrupt the reflex impulses which produce excessive muscle spasm and vascular constriction.

7. Surgery is resorted to only in frankly purulent joint infections. Through and through drainage is established and the extremity is placed in balanced traction and is moved daily through as wide a range as possible. By this method it is possible in many cases to salvage a joint otherwise doomed to ankylosis.

CHRONIC ARTHRITIS

In chronic joint disease an accurate diagnosis is less immediately urgent than in acute arthritis but nevertheless must be established before treatment can be undertaken. It is particularly important to rule out tuberculosis and other chronic granulomatous lesions, including Coccidioides infection; also hemophilia and synovial neoplasms. Biopsy must be resorted to, if necessary.

A. *Chronic Atrophic Arthritis*:

This is a chronic inflammatory disease of the joints accompanied by more or less severe constitutional symptoms. It runs a prolonged course with remissions and exacerbations. The affected joints tend to develop certain characteristic deformities due at first to muscle spasm, and later to fibrous or bony ankylosis. There is demineralization of the bone and impairment of peripheral circulation. Trophic changes in the skin of the extremities and atrophy of the skeletal muscles develop rapidly.

Orthopedic treatment is first concerned with the prevention of deformity. This can be accomplished in the following manner:

1. Careful attention to the position of the patient while in bed.

2. Continuous traction applied to prevent contractures, particularly in the lower extremities.

3. Splints.

4. Casts or shells made from plaster of paris, Castex or celluloid. These should be molded accurately and always should be removable since atrophic arthritis tends to cause ankylosis more rapidly if a joint is splinted continuously.

5. Braces of various types for ambulatory patients, particularly back braces, and caliper splints for the lower extremities. In applying braces, casts and splints, the optimum position of each joint for recovery of function must be borne in mind.

Correction of deformity which has already occurred is a more formidable problem. In early cases deformities may be overcome with splints and braces as described above, with continuous traction, or by means of gentle

manipulation. In more advanced and resistant cases the following measures may be employed.

1. Forcible manipulation. This procedure causes rupture of adhesions and often of contracted portions of the joint capsule. If it is carried out while the arthritis is still active, it may cause a severe local aggravation of the disease. In all cases precaution must be taken to avoid fracture of the demineralized bone.

2. Turnbuckles, incorporated in casts or braces, whereby the contracted joint gradually is forced into the position of election.

3. Surgery may be employed when other means fail. A resection of the contracted joint capsule may suffice. Osteotomies are necessary in the presence of bony ankylosis. Synovectomy is of value in certain cases, usually at the knee. Reconstructive operations, particularly arthroplasty, sometimes are successful in restoring motion in stiff joints but are difficult procedures with uncertain outlook.

Restoration and maintenance of function in joints affected by chronic arthritis is accomplished principally by physical measures:

1. Rest for the body as a whole is as important as in tuberculosis. Local rest is indicated in proportion to the intensity of the inflammation present.

2. Exercise, both active and assisted, is essential in order to maintain motion. An inactive joint in atrophic arthritis will anklyose. In severely crippled patients with multiple joint involvement, counterbalanced hinged splints with traction may be necessary in order to restore and increase the range of motion.

3. Heat, either as radiant heat or diathermy, is of value in all stages of the disease.

4. Massage, properly applied, is perhaps the best method of improving the circulatory deficiencies of arthritic extremities.

5. Ultraviolet radiation, either artificial or in the form of sun baths, is an important adjunct.

6. Artificial fever gives temporary relief in a large number of cases and apparently permanent improvement in somewhat less than 30 per cent.

7. Underwater therapy. Severely crippled and bedridden patients frequently make their start toward rehabilitation in the warm water of the therapeutic pool. This is particularly valuable when weight bearing is begun after a long period in bed or in a wheel chair.

8. Occupational therapy, by providing exercises in an interesting and varied manner, is a valuable supplement to the measures listed above.

B. *Chronic Hypertrophic arthritis.*

Chronic hyperthrophic arthritis or osteoarthritis is a degenerative rather than an inflammatory disease. It definitely is related to trauma and to the stress and strain resulting from faulty body mechanics. It is a disease of the later decades of life. The measures described under chronic atrophic arthritis are all applicable to the hypertrophic form in greater or less degree. It should be noted, however, that no tendency to ankylosis exists; therefore, rest and immobilization by splinting may be employed more freely. The correction of postural difficulties is of great importance as is weight reduction in the obese. Local heat, support and elimination of mechanical strain produces gratifying results in a large proportion of these cases.

FIBROSITIS

Under this heading we include a variety of conditions known to the layman under such terms as muscular rheumatism, lumbago and sciatica. Fibrositis is a rheumatic affection involving the muscles and fascial planes rather than the joints. While not the least painful, it is in the long run the least serious of all types of arthritis. Heat, massage, attention to body mechanics and elimination of infection usually are adequate to effect a cure.

SUMMARY

The principal types of arthritis have been described and their orthopedic treatment outlined. Contrary to the widespread pessimistic attitude in arthritis it is a fact that very few, probably not more than 5 per cent of all arthritic cases are beyond help. The remainder can be benefited and rehabilitated in greater or less degree depending upon the stage of the disease at which treatment is begun and the patience and cooperation of the victim through the tedious and discouraging years which may elapse before the disease finally is arrested.

Atrophy and Regeneration of the Gastrocnemius-Soleus Muscles

Effects of Physical Therapy in the Monkey Following Section and Suture of Sciatic Nerve

Herman Chor, M.D., David Cleveland, M.D., H. A. Davenport, M.D., Ralph E. Dolkart, M.D., and Gertrude Beard, R.N.

The treatment of paralyzed muscles of the flaccid type has been based chiefly on clinical experience. The measures commonly employed are electrical stimulation, massage and passive movement, heat, rest and muscle reeducation. The exact indications for the use of these procedures alone or in combination, however, are still a subject of controversy. Thus, in the treatment of poliomyelitis many clinicians claim that electrical stimulation is contraindicated especially in the early stage of paralysis. They advocate rest. Others stressing the rapid rate of atrophy and degeneration maintain that something should be done to prevent, so far as possible, the progress of atrophy and fibrosis. They decry rest and advocate light massage and passive movement to be followed later by electrical stimulation. A review of the literature reveals considerable confusion and disagreement regarding the value of these measures, with their indications and contraindications.

In view of the need for more precise knowledge as to the actual effects of the commonly used physical therapeutic measures, a series of animal experiments has been undertaken. Macacus rhesus monkeys were used. In the first group of experiments an attempt was made to study the effects of treatment on the course of atrophy and degeneration of denervated muscles. In the second series, treatment was carried out for longer periods of time with a view toward studying the effects on regeneration and restoration of the paralyzed muscles and their nerves.

In the treatment of the lower motor neuron type of paralysis the chief principles of therapy have been based on the concept that inactivity is responsible for the atrophy. The fact that denervated muscle continues to respond to the galvanic current has been utilized in the treatment of flaccid paralysis. By stimulating the paralyzed muscles with the galvanic current an artificial stimulus is substituted for the normal voluntary impulse.

The earliest experimental works on this problem were those of Reid[1] and Brown-Séquard[2] on frogs and rabbits. They reported that daily electrical stimulation prevented atrophy of muscles paralyzed by nerve section. This idea held sway until 1915, when Langley[3] and his associates repeated the experiment on rabbits and found that wasting of the paralyzed muscles progresses despite daily stimulation by the galvanic current.

Does daily electrical stimulation prevent muscle atrophy? In the first experiment of the present investigation the gastrocnemius-soleus muscles were paralyzed by sectioning the sciatic nerve in both lower extremities of two monkeys. The severance was made at the level of the great trochanter. The extremities were kept in protective plaster of paris casts, which were removable. The muscles of the left side were treated by galvanic stimulation, ten good contractions being given daily, the treatment beginning on the day following the operation. The paralyzed muscles of the right lower extremity received no treatment. At the end of six weeks the gastrocnemius-soleus muscles were removed in toto from both extremities and immediately weighed. The re-

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sults may be seen in table 1.

The treated muscles showed slightly more wasting than the untreated. One may question the validity of comparing the same muscle groups of opposite extremities. Our experience with a very large number of monkeys has assured us that the normal variation in weight of the same muscle groups in opposite extremities is very slight. This has been found to be true also in rabbits by Lipshutz and Audova.[4]

In the second experiment three groups of monkeys in which one sciatic nerve was sectioned and sutured were treated as follows: One group received daily electrical stimulation (ten good contractions by galvanic current), another daily massage and passive movement, and the third group complete rest by immobilization in a cast. The opposite extremity served as the control in each animal. The paralyzed extremity was placed in a removable protective plaster cast in all groups. Treatment was not begun until two weeks after the nerve section, during which period the paralyzed muscles were kept at rest in a neutral position in their protective casts. At the end of four weeks of treatment (six weeks after nerve section) the gastrocnemius-soleus muscles were removed and the amount of atrophy was determined by comparing the weight of the paralyzed muscles with that of the normal control side. The results may be seen in table 2.

The amount of atrophy was practically the same in the three groups. We may conclude, therefore, that muscle atrophy following nerve section in the Macacus rhesus monkey progresses up to a period of at least six weeks despite treatment by electrical stimulation, by passive movement and massage or by complete rest. It should be emphasized that these observations deal only with the amount of atrophy. It may be mentioned at this time that demonstration of atrophy in terms of wasting of muscle is not an accurate guide to the severity of the lesion. The qualitative changes occurring in the muscle fibers, intramuscular nerves and blood vessels must be evaluated. The degree of muscle degeneration and fibrosis and the amount of functionally preserved muscle fibers are the important determinants of the future restoration of the muscle when reinnervated.

What are the effects of treatment on the regeneration and restoration of muscles? The following experiments were carried out to compare the effects of electrical stimulation, of massage and passive movement and of immobilization, maintained for a period of time long enough to permit regeneration of the nerve to the paralyzed muscles. Four groups of animals were used in this experiment. In each monkey the right sciatic nerve was severed and sutured immediately. Removable plaster of paris casts were applied to the paralyzed extremity for protection and also to serve as a splint for the denervated gastrocnemius-soleus muscles. A period of four weeks of rest was allowed before active treatment was begun. One group received daily electrical stimulation (ten contractions, galvanic current), another group received daily massage and passive movement, a third group received the combination treatment of daily elec-

TABLE 1 (EXPERIMENT A).—IMMEDIATE TREATMENT BY ELECTRICAL STIMULATION (GALVANIC CURRENT, TEN CONTRACTIONS DAILY)

Sciatic nerve sectioned bilaterally and sutured immediately. Period of treatment six weeks.

Monkey No.	Left Side (treated) (Gm.)	Right Side (control) (Gm.)	Difference (Gm.)
15	11.88	12.66	0.78 more trophy on treated side
16	10.90	11.77	0.87 more atrophy on treated side

TABLE 2 (EXPERIMENT B).—TREATMENT STARTED AFTER TWO WEEKS OF REST (PERIOD OF TREATMENT FOUR WEEKS)

Sciatic nerve of left lower extremity severed and sutured immediately. Right side normal control.

Treatment	Monkey No.	Weight Paralyzed Muscles, Gm.	Weight Control Muscles, Gm.	Weight Loss, Gm.	Atrophy, %
Electrical stimulation (10 contractions)	17	8.63	19.24	10.56	54.88
Massage and passive movement	18	8.48	19.24	10.80	56.01
Rest (immobilization in cast)	19	7.47	17.17	9.70	56.49
	20	10.26	21.60	11.34	52.50
	21	12.30	25.79	13.49	52.50

trical stimulation and also massage and passive movement, and the fourth group was kept immobilized in the plaster cast in a state of continuous and prolonged rest. After two months of treatment (three months following nerve section and suture) the gastrocnemius-soleus muscles were removed and weighed. The results are seen in table 3.

A similar experiment was carried out on another group of animals; the period of treatment, however, was longer (five months). Treatment was begun after four weeks rest, during which time the paralyzed muscles were splinted and protected in a plaster cast.

A final experiment was conducted, treatment being started immediately following

nerve section and suture without allowing a rest period of four weeks before beginning treatment, as was the condition in the previous two experiments. An additional group of animals was included, these monkeys receiving no supervised treatment whatever following the nerve section and suture. They were kept in cages during the six months course of the experiment and were examined weekly as to the appearance of voluntary movement and return of faradic response. The treatment period in this experiment was for six months. All casts were removed at the end of five months so as to permit active movements of the recovering muscles. The results may be seen in table 5.

TABLE 3 (EXPERIMENT C).—TREATMENT STARTED AFTER FOUR WEEKS' REST (PERIOD OF TREATMENT TWO MONTHS)

Left sciatic nerve severed and sutured immediately. Right side normal control.

Treatment	Monkey No.	Weight Paralyzed Muscles, Gm.	Weight Control Muscles, Gm.	Difference Gm.	Atrophy, %
Electrical stimulation	22	10.81	21.09	10.28	48.7
	23	9.08	25.76	16.68	64.7
Massage and passive movement	24	11.93	15.82	3.89	24.5
	25	13.12	17.34	4.22	24.3
Combined electrical stimulation and massage and passive movement	26	11.032	19.260	8.22	42.7
	27	7.945	16.365	8.42	51.3
Immobilization in plaster cast	28	6.925	16.456	9.531	57.9

TABLE 4 (EXPERIMENT D).—TREATMENT BEGUN AFTER FOUR WEEKS' REST (PERIOD OF TREATMENT FIVE MONTHS)

Left sciatic nerve severed and sutured immediately. Right side normal control.

Treatment	Monkey No.	Weight Paralyzed Muscles, Gm.	Weight Control Muscles, Gm.	Difference Gm.	Atrophy, %
Electrical stimulation	29	13.53	32.63	19.10	58.5
	30	17.85	25.97	8.12	31.2
	31	9.97	19.63	9.66	44.1
Massage and passive movement	32	17.25	19.28	2.03	10.5
	33	20.42	25.10	4.68	18.6
Immobilization in plaster cast	34	7.64	19.45	11.81	60.7
	35	4.90	12.09	7.19	58.7

The results of this experiment are in accord with the two previous ones. The best restoration of muscle bulk was obtained in two groups, one of which received massage and passive movement therapy and the other no supervised treatment. The poorest response was in the group of animals immobilized in plaster casts with no additional treatment.

COMMENT

Our studies indicate that atrophy and degeneration of denervated skeletal muscle are just as inevitable as are the changes which occur in the peripheral portion of a severed nerve. We have shown that no form of physical therapy prevents atrophy up to a period of six weeks.

From a clinical point of view, atrophy has been the feature receiving most attention by many in dealing with paralyzed muscles of the flaccid type. As already noted, the qualitative changes in the paralyzed muscles, rather than the quantitative loss of bulk, determines in great measure the type of response to therapy that can be expected when the regenerated nerve again innervates the paralyzed muscle. Microscopic studies[5] show that, associated with atrophy and degeneration of denervated muscle, reparative and regenerative phenomena go hand in hand. The striking increase in sarcolemmal and muscle nuclei is the first evidence of this reaction. After the degeneration of the muscle cells, however, fibrosis soon follows. This response of fibrous tissue cells, derived in part from the sarcolemmal nuclei and from the degenerated muscle, occurs insidiously. Microscopic

TABLE 5 (EXPERIENCE E).—SIX MONTHS' TREATMENT; NO PRELIMINARY REST

Treatment	Monkey No.	Weight Paralyzed Muscles, Gm.	Weight Control Muscles, Gm.	Difference Gm.	Atrophy, %
Electrical stimulation	36	15.08	35.05	19.93	56.92
	37	16.315	35.70	19.385	54.29
Passive movement and massage	38	15.00	23.70	8.70	36.7
	39	27.21	42.41	15.20	35.85
Combined electrical stimulation and massage and passive movement	40	21.11	44.75	23.64	52.82
	41	died			
Immobilization in plaster cast	42	14.22	42.11	27.89	66.24
	43	15.79	40.49	24.70	61.00
"No treatment"	44	27.64	41.24	13.60	32.97
	45	29.71	45.52	15.81	34.73

studies show that by six weeks, at which time there is evidence of longitudinal splitting within the degenerating muscle fibers, fibrosis makes its appearance. It is not prominent, however, until the later stages.

The excessive invasion of the damaged muscle by fibrous tissue not only replaces the muscle fibers which have undergone degeneration but also exerts a damaging effect on the remaining parenchyma by compression and "cirrhosis." Excessive fibrosis interferes with the circulation in the muscle and also retards the regeneration of muscle fibers. Since muscle regenerates by outgrowth from the healthy stumps of partially degenerated muscle cells, the importance of preserving the parenchyma is obvious.

It is commonly emphasized throughout the literature on the treatment of flaccid

paralysis that the condition of the remaining muscle is the important factor in determining the degree of muscle repair and recovery which follows the regeneration of the peripheral nerve. The process of muscle atrophy and degeneration, however, progresses despite attempts at early therapy. Treatment does influence the quality of the denervated muscle (1) by aiding the circulation and (2) by minimizing fibrosis.

It may be seen from the present experiments that each type of therapy resulted in a rather clearcut response on the part of the regenerating muscle. In experiment D, the best restoration of muscle bulk occurred in the group of animals which received massage and passive movement therapy. A recovery of 81.4 per cent (18.6 per cent atrophy) and 89.5 per cent (10.5 per cent atrophy) after six months clearly supports this conclusion. In experiment E it may be noted that the best results were obtained in two groups, one receiving massage and passive movement and the other receiving "no treatment." In each instance a recovery of approximately 65 per cent (35 per cent atrophy) was obtained. It should be noted that the group which received "no treatment" were kept in small cages which minimized stretching of the paralyzed muscles and yet permitted some degree of motion equivalent to passive movement.

The poorest results were obtained in those animals in which the paralyzed limb was kept in complete and prolonged immobilization by means of a plaster cast. This was a constant finding in all the experiments. Its explanation is obvious. Grossly there was marked fibrosis and ankylosis at the ankle and knee joints. The gastrocnemius-soleus muscles were surrounded by thickened septums of fibrous tissue, and throughout the pale muscles were whitish and yellowish streaks—cords of dense fibrous tissue. Microscopically this fibrosis was clearly demonstrable both surrounding and within the muscle fibers. Such a state of "cirrhosis" of the muscle hinders the restorative process.

The results of therapy by electrical stimulation suggest that this form of treatment does not give as good a restoration of the bulk of regenerating muscle as may be obtained by massage and passive movement. Further studies correlating the restoration of muscle bulk with muscle function are needed in order to establish more definitely the effects of these therapeutic measures.

A noteworthy finding was the uniformly better results obtained in the animals which were permitted a preliminary period of rest of four weeks (the paralyzed muscles supported in a neutral position by plaster casts) before treatment was instituted. The results support the clinical impression that rest is indicated in the early stage of lower motor neuron paralysis.

CORRELATION OF MUSCLE RESTORATION WITH NERVE REGENERATION

A study of the regenerated nerves to the gastrocnemius-soleus muscles was made to determine whether or not there is any correlation between regeneration of muscle and regeneration of nerve. It was found that at the end of three months 60 per cent of the normal number of fibers of the sciatic nerve made their appearance in the regenerating distal portion.[6] Of these there were twice as many unmyelinated as myelinated fibers. In table 6 the number of regenerated nerve fibers are listed along with the percentage of atrophy of the gastrocnemius-soleus muscles grouped according to the type of physical therapy employed.

The total number of regenerated fibers in the distal portion of the operated sciatic nerve varied between 51,000 and 94,000, with an average of approximately 60,000. In monkey 25, in which the best restoration of muscle occurred, 24 per cent atrophy, there were 65,000 regenerated fibers, whereas in monkey

TABLE 6.—CORRELATION OF MUSCLE RESTORATION WITH NERVE REGENERATION
Three Months After Sciatic Nerve Section and Suture (4 Weeks Rest in Cast Before Beginning Treatment)

Treatment	Monkey No.	Muscle Atrophy	Regenerated Sciatic Nerve Fibers		Regenerated Branches to Gastrocnemius-Soleus Muscles		Maturity of Fibers	Return of Voluntary Movement (No. of Days)	Return of Faradic Response (No. of Days)
			Total	Myelinated	Total	Myelinated			
Electrical stimulation	22	40%	55,000	25,000	8,744	3,600	Mature	73	80
	23	65%	60,000	22,000	5,500	883	Immature	None at 90 days	None at 90 days
Massage and passive movement	24	25%	82,000	19,600	7,700	2,500	Mature	55	70
	25	24%	65,000	15,000	4,287	2,000	Medium Mature	None	None
Immobilization	29	58%	58,000	22,000	10,000	2,200	Mature	None	None
Combined electrical stimulation and massage and passive movement	26	43%	51,000	23,000	.....	2,500	Mature	70	80
	27	51%	94,000	24,000	10,000	2,800	Mature Medium	None	None
			Average 60,000						

Total fibers in normal sciatic approximately 100,000; myelinated, 35,000.

23, in which the poorest restoration occurred, 65 per cent atrophy, there were 60,000 regenerated fibers. There appears to be no definite correlation between the total number of regenerated fibers of the sciatic nerve and restoration of the gastrocnemius-soleus muscles. The number of myelinated fibers in the regenerated nerve was fairly constant throughout the series and it may be concluded that the degree of myelination of the fibers likewise is not directly related to the restoration of muscle.

TABLE 7.—CORRELATION OF MUSCLE RESTORATION WITH NERVE REGENERATION

Six months after sciatic nerve section and suture.
(Four weeks rest before treatment)

Treatment	Monkey	Atrophy	Regenerated Sciatic Nerve Fibers: Total	Regenerated Sciatic Nerve Fibers: Myelinated	Return of Voluntary Movement (No. of Days)	Return of Faradic Response (No. of Days)
Electrical stimulation	29	50%	69,000	22,000	158	152
	30	31%	76,000	33,500	158	152
	31	44%	.....	32,000	163	152
Passive movement and massage	32	11%	90,000	.....	92	87
	33	19%	90,000	36,000	76	87
Immobilization	34	61%	85,000	19,000	None	None
	35	59%	102,000	28,000	None	None

Average 84,000

Total fibers in normal sciatic, 100,000; myelinated, 35,000.

After six months the number of regenerated nerve fibers reaches 80 per cent of the normal.[7] Therefore, three times as many regrew in the first three months period as the number added during the second three months period. The process of myelination seems to keep pace with the regrowth of axis cylinders. In table 7 the number of regenerated sciatic nerve fibers found six months after nerve section and suture is compared with the restoration of muscle in each instance.

The number of regenerated fibers in the sciatic nerve varied between 69,000 and 102,000, with an average of approximately 84,000. There is no direct correlation between the number of regenerated fibers and the restoration of muscle. The number of myelinated fibers was approximately one third of the total—the same ratio found after three months' regeneration. In this series the poorest myelinization occurred in monkey 34, in which the poorest restoration of muscle was found. In the monkeys with good muscle recovery, myelinization of the regenerative fibers was correspondingly good.

In the third group of monkeys, nerve fiber counts were made of the regenerated branches to the gastrocnemius muscles. A considerable variation in total number of fibers was found. This is true also in the normal, in which the total number of fibers varied from 11,000 to 21,000. In this group there is no definite correlation between the number of regenerated nerve fibers and restoration of muscle, but it would appear that for regeneration of muscle a minimal number of regenerated nerve fibers must be present.

TABLE 8.—CORRELATION OF MUSCLE RESTORATION WITH NERVE REGENERATION

Six months after sciatic nerve section and suture.
(No rest preceding treatment)

Treatment	Monkey No.	Regenerated Branches to Gastrocnemius-Soleus Muscle: Muscle Atrophy	Regenerated Branches to Gastrocnemius-Soleus Muscle: Total No. of Fibers	Regenerated Branches to Gastrocnemius-Soleus Muscle: Maturity of Fibers	Return of Voluntary Movement (No. of Days)	Return of Faradic Response (No. of Days)
Electrical stimulation	36	57%	11,170	Mature	122	105
	37	54%	5,920	Immature	118	112
Passive movement and massage	38	37%	8,120	Mature	95	105
	39	36%	8,360	Medium Mature	96	105
Immobilization	42	66%	12,480	Immature	146	No response
	43	61%	8,340	Medium	146	105
Combined electrical stimulation and passive movement and massage	40	53%	11,780	Immature	120	105
	41	Died				
No treatment	44	33%	5,800	Medium	132	105
	45	35%	8,050	Medium Mature	132	105

Total fibers in normal varied from 11,000 to 21,000

There was considerable variation in the number of days following nerve section and suture at which voluntary movement returned. In each experiment the earliest recovery was found in those animals which received massage and passive exercise. The poorest functional recovery was in the animals treated by prolonged immobilization in plaster casts. The fibrosis in the muscle and about the joints and ligaments may interfere with movement of the muscle despite the apparently good regeneration of the nerve. The return of motor function was found to vary considerably, as early as fifty-five days in monkey 24 and as late as 158 days in others. No return of voluntary movement was noted in several of the animals immobilized in plaster casts for six months.

The return of faradic response likewise was very inconstant and no conclusions can be drawn from the data on hand. There is a definite need for further study to correlate the return of function with the restoration of muscle and nerve.

Conclusions

1. Atrophy and degeneration of denervated muscle progress up to a period of at least six weeks despite treatment by passive movement and massage or by electrical stimulation.

2. Regeneration and restoration of skeletal muscle, previously denervated, occurs with reinnervation. Unless hindered by excessive fibrosis (prolonged immobilization) or damage to the muscle parenchyma, a good recovery of muscle bulk can be expected.

3. Regeneration of the peripheral nerve occurs at a fairly constant rate. At the end of three months the number of regenerated fibers reaches 60 per cent of the normal. At the end of six months, regeneration of the nerve fibers reaches 80 per cent.

4. The degree of regeneration of the peripheral nerve is not (actually) influenced by the use of physical therapy measures.

5. There is no direct correlation between the number of regenerated nerve fibers and the restoration of muscle. It would appear, however, that for regeneration of muscle a minimal number of regenerated nerve fibers must be present.

6. The condition of the remaining muscle is the important factor in determining the degree of muscle repair and recovery which follows the regeneration of the peripheral nerve. In the restoration of muscle, physical therapy is of value. Massage and passive movement therapy appear to be the most beneficial. A preliminary rest period of four weeks before treatment gives uniformly better results than obtained when treatment is given immediately following nerve section and suture. During this rest period the paralyzed muscles should be splinted in neutral position.

7. Further studies are needed to correlate the restoration of function with the return of muscle bulk in order to establish more definitely the effects of physical therapy measures.

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"Twenty-Second Annual Hospital Standardization Report," Bulletin of the American College of Surgeons, October 1939.

Department of Physical Therapy—Hospitals are becoming more aware of the value of physical therapy in the treatment of certain diseases and find considerable use for such a department. The requirements as laid down by the American College of Surgeons in the Minimum Standard for Physical Therapy Departments in Hospitals will serve as a guide to hospitals desirious of organizing a modern physical therapy service. These requirements are explained in detail in the *Manual of Hospital Standardization.*

That the department be under competent medical supervision is most essential, as physical therapy must be properly administered and the best results are accomplished when the director is a medical graduate and has had special training in this field. Unskilled administration of treatment may produce harmful results.

Well trained technicians should be made available to assist the director in treating these cases. Registration with the American Registry of Physical Therapy Technicians as sponsored by the American Congress of Physical Therapy is improving the status of the physical therapy technician. Hospitals may protect themselves against unqualified personnel in this department by employing registered persons. The educational standards for technicians or aids have been well established by the American Physiotherapy Association.

Hospitals will find it advantageous to provide this form of treatment, which has most definite potential value in hastening convalescence and stabilizing end results. The limited number of qualified physical therapists available makes it necessary for several institutions in some instances to share the time of one specialist in this work. In organizing a service such as this, the American College of Surgeons offers its assistance.

The
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At the National Convention in Denver last June, considerable emphasis was placed upon the importance of having strong State physical therapy organizations. Because of the results of a recent survey of our membership-at-large, which showed that a majority of these people felt the need of closer contact with other members of our profession, we are again reviewing the advantages of chapter organization.

Unquestionably State chapters provide opportunity for more frequent meetings, thereby stimulating professional interest and promoting discussions on current physical therapy subjects. Annual and semiannual state meetings, with a planned program, and smaller meetings held by local groups during the year in various parts of the State, arouse interest and curiosity concerning physical therapy among professional and lay groups. Not only do we thus further the science of physical therapy but we reap personal rewards, for active participation in any organization develops personality and interest.

Today, in medical and allied professions, better organization of all groups is essential if the identity of any one group is to be maintained. A well-organized group with definite ideals is a far greater force in any community than is an individual. The perennial task of defeating ill-advised legislation requires vigilant, alert and often coordinated participation by medical groups in order to be successful. It is only through strong organization that we can safeguard our professional standards.

The goal of the National Executive Committee for this year is to incorporate as many as possible of our 296 members-at-large into State chapters. To this end, we solicit the earnest cooperation and energetic effort of both chapters and members-at-large.

THE EXECUTIVE COMMITTEE.

A New Chapter

Notice has been received of the formation of a Maine chapter, the officers of which are listed in the chapter directory.

We are pleased to announce that Miss Jessie L. Stevenson, who is a charter member of the Chicago Chapter and at one time served as its president, has been appointed as orthopedic consultant to the National Organization for Public Health Nursing, beginning as of October 1, 1939. This appointment for a year's project in orthopedic nursing has been made possible through an appropriation from the National Foundation for Infantile Paralysis. The aim of this project is to prepare a manual or orthopedic nursing for the use of public health nurses and to assist in the preparation of nurses for work with crippled children.

Miss Stevenson, who has an unusual background of experience in both public health nursing and orthopedic nursing, has been a member of the staff of the Visiting Nurse Association of Chicago since 1922, and has served as supervisor of the Orthopedic Division since 1923. She received her Bachelor of Arts degree from the University of South Dakota, is a graduate of the school of nursing of the Presbyterian Hospital of Chicago and in 1936 received her certificate in physical therapy from Northwestern University Medical School. In 1924, during her leave of absence from the Visiting Nurse Association, she made a survey for the Chicago Community Trust on "Crippled Children in Chicago."

Prior to entering the profession of nursing Miss Stevenson taught English in high schools in Minnesota and South Dakota. She also did private duty nursing for a year before entering the field of public health nursing.

Since 1936 Miss Stevenson has been a val-

uable member of the editorial staff of THE PHYSIOTHERAPY REVIEW, serving in the capacity of associate editor. She also has been devoting part of her time since 1928 to giving instruction in physical therapy at Northwestern University Medical School.

At the 18th annual convention a new committee was formed to establish relations between the American Physiotherapy Association and other organizations. Miss Hazel Furscott, 219 Fitzhugh Bldg., San Francisco, Calif., was appointed as chairman of this committee on relations.

At the present time there are the following representatives from the American Physiotherapy Association to

(1) *Advisory Board of the American Registry of Physical Therapy Technicians*—Janet B. Merrill, 300 Longwood Avenue, Boston, Mass.

(2) *Advisory Committee of "The Crippled Child" Magazine*—Emmy Kylin, 409 Prospect Road, Ashtabula, Ohio.

(3) *Advisory Committee on Services for Crippled Children*—Mildred Elson, 737 N. Michigan Avenue, Chicago, Ill.

(4) *National Organization for Public Health Nursing*—Florence Phenix, 522 N. Pinckney, Madison, Wis.

The exhibit on the treatment of spastic paralysis which was awarded the prize at the eighteenth annual convention was shown at the meeting of the American Congress of Physical Therapy in New York City, September 5 to 8, 1939, and at the convention of the National Society for Crippled Children in Dallas, Texas, October 22 to 25, 1939.

Nineteenth Annual Convention

The nineteenth annual convention of the American Physiotherapy Association will be held in New York City, June 23 to 28, 1940.

Chartered Society of Massage and Medical Gymnastics

Because of the uncertainty of the international situation, the Chartered Society of Massage and Medical Gymnastics canceled the Congress and all meetings that were to have been held in London, England, during Congress week, September 18 to 22, 1939.

New Society of Physical Therapy Physicians

Dr. Frank H. Ewerhardt, St. Louis, and Dr. William Bierman, New York, were chosen president and president-elect respectively of the Society of Physical Therapy Physicians at its organization and first annual meeting in New York, September 5-8, 1939. Its membership will be restricted to physicians who devote themselves exclusively to the practice of physical therapy in contradistinction to those of the American Congress of Physical Therapy, which includes all ethical physicians and surgeons who are interested in physical therapy while engaged in general practice.

European Journals and the War

The nonreceipt by a subscriber of any European chemical or other scientific journal seriously needed as research material should be reported promptly to the American Documentation Institute.

Reports, with full details of where subscription was placed and name and address of subscriber, volume, date and number of last issue received, should be addressed to:

American Documentation Institute, Bibliofilm Service, in care of U. S. Department of Agriculture Library, Washington, D. C.

In the October 1939 issue of the *Archives of Physical Therapy* appears a special article on the American Registry of Physical Therapy Technicians, including the revised outline of rules, regulations and ethics. This is intended to serve as a concise and ready reference of the scope and operative plan in the relationship of institutional and private physical therapy practice so far as it concerns the technic. A complete directory of the registered technicians also is given.

Central New York Chapter

Mrs. Clara Truesdell, a member of the Central New York Chapter, died last Spring after a long illness.

Index to Current Literature

ALLERGY

Experience with an Allergen-Free Room. HOWARD OSGOOD, M.D. Hospitals, Oct. 1939.

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Amputation Stumps of the Lower Extremity. PAUL C. COLONNA, M.D., and FREDERICK VOM SAAL, M.D. J.A.M.A., Sept. 9, 1939.

Amputations for Peripheral Arterial Obliterative Disease. HENRY H. FAXON, M.D. J.A.M.A., Sept. 23, 1939.

ARTHRITIS AND RHEUMATIC DISEASES

Fever Therapy in Acute Rheumatic Disease. E. E. SIMMONS, M.D., and F. LOWELL DUNN, M.D. Arch. P. T., Sept. 1939.

Treatment Apparatus for Rheumatism. J. CHART. SOC. M. AND M. GYM., Sept. 1939.

Therapy of Cook County Hospital: Chronic Arthritis. BERNARD FANTUS, M.D., in collaboration with DR. EUGENE F. TRAUT. J.A.M.A., Aug. 19, 1939.

The Delayed Appearance of Heart Disease After Rheumatic Fever. EDWARD F. BLAND, M.D., and T. D. JONES, M. D. J.A.M.A., Oct. 7, 1939.

Fever Therapy in Rheumatic Fever. Queries and Minor Notes, J.A.M.A., July 22, 1939.

Short Wave in Rheumatism. Abst. in J.A.M.A., July 8, 1939.

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Wood Smoke as a Cause of Asthma. BEN Z. RAPPAPORT, M.D., and RUDOLPH HECHT, M.D. J.A.M.A., Sept. 9, 1939.

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Simplified Internal Fixation of Inlay and Onlay Bone Grafts. O. L. MILLER, M.D., J.A.M.A., Aug. 19, 1939.

The Recurrence of Flexion and Adduction Deformities Following Operative Fusion of the Hip and Subtrochanteric Osteotomy. F. HAROLD DOWNING, M.D. J. Bone and J. Surg., Oct. 1939.

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The Use of Insulin as an Adjunct in the Treatment of Bone and Joint Tuberculosis. RUSSELL L. NICHOLS, M.D., and EDWARD L. COMPERE, M.D. J. Bone and J. Surg., Oct. 1939.

Tuberculosis of the Knee. F. M. MCKEEVER, M.D. J.A.M.A., Sept. 30, 1939.

Bone and Joint Tuberculosis. JOHN F. LE COCQ, M.D. Northwest Med., Sept. 1939.

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A Factor Analysis of the Acne Complex with Therapeutic Comment. JOHN H. STOKES, M.D., and THOMAS H. STERNBERG, M.D. Arch. Derm. and Syphil., Sept. 1939.

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DIATHERMY

Infantile Dacryocystitis Treated by Surgical Diathermy. ALLISTER M. MACGILLIVRAY, M. D. Brit. J. Ophthal., Sept. 1939.

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Thermophore Treatment of Retinal Detachment. LAWRENCE T. POST, M.D. Southern Med. J., Mar. 1939.

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Conservative Treatment for Fracture of the Os Calcis. H. GURTH PRETTY, M.D. Canad. Med. Assoc. J., July 1939.

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The Principles of the Treatment of Injuries. T. T. STAMM, M.B. J. Chart. Soc. M. and M. Gym., Oct. 1939.

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The Effect of Temperature upon the Vitality of Spermatozoa. ABNER I. WEISMAN, M.D. Am. J. Obst. and Gynec., Aug. 1939.

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Angio-Endothelioma of Bone. J. F. LUTZ, M.D., and LEWIS C. PUSCH, M.D. J.A.M.A., Sept. 9, 1939.

Some Remarks on the Cause of Essential Hypertension. JOHN M. SCHIMMENTI, M.D. Med. Times, Sept. 1939.

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Amputations for Peripheral Arterial Obliterative Disease. HENRY H. FAXON, M.D. J.A.M.A., Sept. 23, 1939.

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The Methods Used in Handling the Epidemic of Poliomyelitis in Ontario in 1937. A. B. LEMESURIER, M. B. J. Bone and J. Surg., Oct. 1939.

An Epidemic of Poliomyelitis in Which Bulbar Paralysis Occurred with Unusual Frequency. ERNEST L. STEBBINS, M.D.; EDWARD E. GILLICK, M.D., and HOLLIS E. INGRAHAM, M.D. J.A.M.A., Oct. 21, 1939

REHABILITATION

Rehabilitation after Accident J. CHART. SOC. M. AND M. GYM., Sept. 1939.

A Programme for the Vocational Adjustment of the Physically Handicapped. TERRY C. FOSTER. Canad. J. Occup. Ther., Oct. 1939.

TUBERCULOSIS

The Use of Insulin as an Adjunct in the Treatment of Bone and Joint Tuberculosis. RUSSELL L. NICHOLS, M.D., and EDWARD L. COMPERE, M.D. J. Bone and J. Surg., Oct. 1939.

Tuberculosis of Tendons, Tendon Sheaths and Bursae about the Head FRANK N. POTTS, M.D. N. Y. State J. Med., May 15, 1939.

Bone and Joint Tuberculosis. JOHN F. LE COCQ, M.D. Northwest Med., Sept. 1939.

Tuberculosis of the Knee. F. M. MCKEEVER, M.D. J.A.M.A., Sept. 30, 1939.

VOCATIONAL TRAINING

Vocational Training for the Crippled Child. O. H. JOHNSON. The Crippled Child, Oct. 1939.

ABSTRACTS

John S. Coulter, M. D.

Fever Therapy by Physical Means

Frank H. Krusen, M. D., and Earl C. Elkins, M. D., Rochester, Minn. In the J. A. M. A., 112:17:1689, April 29, 1939.

A carefully trained team consisting of technicians and a physician is essential to the safe conduct of fever therapy. The personnel of the fever therapy department is almost as important as the personnel of the operating room. A competent physician familiar with all the reactions which can be evoked by this type of therapy should be in attendance at all times during the treatment. The treatments should be administered by registered nurse-technicians who have been trained for at least one month or six weeks in a well organized fever therapy department of a hospital or under the close supervision of some person who has had such training. It has been said "The percentage of cooperative patient is directly related to the expertness and the tact of the nurse in charge." Failure to achieve a measure of success with fever therapy in many

institutions arises from the fact that the attending nurses have not been adequately trained and are not familiar with the physiological principles that are essential to effective treatment. For many reasons the use of fever therapy should be confined to institutions. It must be borne in mind at all times that fever therapy is not without danger. Though it is entrusted to a corps of highly trained workers, serious complications can and do occur during its administration.

Subacute Bacterial Endocarditis (Endocarditis Lenta)—It has been demonstrated definitely that, although there is some slight temporary relief of pain and a lowering of temperature following artificial fever therapy, no permanent beneficial effects can be noted after the hyperpyrexic treatment of patients having subacute bacterial endocarditis.

Bronchial Asthma—Despite the fact that in a fairly large number of cases of intractable bronchial asthma fever therapy has brought about favorable results, it is felt that it should not be attempted in such cases unless all other means have failed.

Chorea—The total number of cases of chorea treated by artificial fever induced by physical means is still too small to permit formation of any final conclusions. The studies do indicate, however, that the treatment of chorea by this method should be continued in well equipped institutions. Several investigators have found that choreiform movements cease in as many as 80 per cent of cases.

Gonorrhea—The effects of artificial fever therapy produced by physical means on gonorrhea and its complications are conclusive. Reports by several investigators are available concerning the pyrexic treatment of gonorrhea in a large series of cases. More than 1,000 cases of gonorrhea treated by artificial fever induced by physical means have been recorded during the past five years. The percentage of remissions in the series of cases previously mentioned has been approximately 90. The rationale of the application of fever therapy to gonorrhea has been based, of course, on the thermolabile properties of the gonococcus.

Gonorrheal Arthritis—In most cases startlingly good results have been obtained with artificial fever in the treatment of gonorrheal arthritis. Most reports show that approximately 60 to 80 per cent of the patients become symptom free and that an additional 10 per cent are markedly improved; the other 10 per cent remain unimproved. The results are better when the treatment is instituted early in the course of the disease than when it is delayed until the disease has reached a chronic stage. The procedure used in the treatment of gonorrheal arthritis is the same as that for gonorrhea in general.

Infectious Arthritis—About 30 per cent of one group of patients with infectious arthritis who were treated with artificial fever were significantly improved. The other 70 per cent exhibited little or no improvement. Fever sessions of short duration, during the course of which the bodily temperatures are elevated to from 101 to 103 F. (38.3 to 39.4 C.) by means of fever cabinets and hot baths, have been used; in conjunction with other corrective physical therapy they have appeared to be of benefit.

Syphilis (Early Primary)—Preliminary clinical investigations seem to indicate that, when artificial fever therapy is combined with chemotherapy, better results can be obtained than by the use of either form of therapy alone. However, in its present stage of development, fever therapy could not possibly be made available to the average patient having a primary syphilitic lesion. When the bodily temperature has been elevated to more than 105 F. (40.5 C.) for fifty hours in ten sessions of five hours each, this procedure being combined with thirty injections of an antisyphilitic chemical agent, cutaneous manifestations of the disease, including chancres, have been reported to respond with surprising promptness, so that no living, motile spirochetes can be found in any of the primary lesions after the first fever treatment.

Dementia Paralytica—The use of artificial fever produced by physical means in the treatment of dementia paralytica is becoming more and more extensive; however, there is still insufficient evidence available for the investigator to conclude that such fever will be more or less satisfactory than malarial fever. Most observers who have made careful comparative studies feel that fever produced by physical means offers a slightly higher percentage of immediate clinical remissions than does therapeutic malarial fever; however, it has been claimed by certain authorities in the field of syphilology that the relapse rate for physically induced fever will be higher than that for malarial fever. Certainly it will be several years before any final conclusions can be drawn; nevertheless, the best available comparative studies indicate that 70 per cent of patients with dementia paralytica who were treated with physically induced fever were

immediately benefited by the treatment and that two years and eight months later 66.6 per cent of them remained improved; whereas, of a control group treated by malarial therapy, 63.3 per cent were improved immediately and two years and eight months later 56.6 per cent remained improved. These observations seem to indicate that the response of dementia paralytica to physically induced fever is apparently as well sustained as improvement brought about by therapeutic malaria. Much larger series of cases will have to be studied before final conclusions can be drawn.

Tests for Athletic Efficiency

Sir Adolphe Abrahams, O.B.E., M.D. Camb., F.R.C.P. Lancet, No. VI of II:6049:309, August 5, 1939.

The subject of physical fitness is very much in the air. The Government has considered it desirable to institute an elaborate investigation. Our profession naturally will be consulted; our opinion frequently will be requested; on very rare occasions it may even be paid for. That is my excuse for bringing forward so elementary a communication.

For practical purposes the comparatively simple methods in common use to estimate the physical efficiency of the healthy athlete are probably as satisfactory as the more elaborate investigations, which are, after all, only extensions of fundamental principles. In general we depend upon the response of the circulation to effort, as denoted by cardiac acceleration or by variation in blood pressure; and since the reaction of the vasomotor system is the essential criterion, it may be regarded as sufficient to ascertain the alterations which occur in changing from the horizontal to the vertical position, even if effort is entirely eliminated by strapping the subject to a tilting table. In a fit subject the vasomotor system quickly adjusts itself, and the increased vasomotor tone is demonstrated by a small rise in blood pressure; in the unfit the veins fill first and the cardiac rate accelerates by way of compensation for the sudden fall in arterial pressure—doubtless a carotid-sinus reflex.

On the whole, I believe any method into which blood pressure estimations enter to be fallacious. The influence of emotion often is considerable in the highly sensitive nervous type not infrequently encountered among track athletes.

The degree of cardiac acceleration I do not consider to be of any great consequence; for, after all, cardiac output may be increased in one subject mainly by acceleration and in another by increasing the stroke volume. But the rate of deceleration I believe to be a valuable index of fitness. As a rule, deceleration begins within 10-15 seconds of the cessation of exercise and continues regularly with a return to the resting rate within 45 seconds. But in a few outstanding examples, of whom the leading British runner of the present day is one, a different result has been noted; the tachycardia persists for approximately one-half minute and suddenly yields to the resting rate. It seems as if the circulatory system works on two tears, so to speak. There must be some "clicking over" of a nervous regulatory mechanism, but I cannot find a satisfactory physiological explanation. This simple test I have found to be an adequate guide to fitness during training; a bad result encourages a search for the cause, usually a toxin. Incidentally, I may say I am appalled at the carelessness of the average athlete in elementary hygiene (septic teeth and tonsils, neglect of the bowels, boils, and various skin eruptions).

Peripheral Vascular Diseases

William S. Collens, M. D., and Nathan D. Willensky, M. D., Brooklyn, New York. In New York State J. Med., 30:14:1360, July 15, 1939.

After the clinical diagnosis of peripheral arterial disease has been established, it becomes important to determine whether it is due to vasospastic stimulation or organic disease. If both are present the proportionate role of each element must be established.

One of the most valuable tests for this differential diagnosis is the Landis-Gibbon test. It is based upon the principle of the elevation in the surface temperature of the digits when vasomotor relaxation is produced. If the test is to be performed in the lower extremities, a reading of the skin temperature on the tips of the digits or the matrix of the nails is taken. The upper extremities are then immersed in hot water at 115 F. for one-half hour. A profound vasodilatation in the lower extremities is reflected by a rise in their surface temperature approximating that of the body temperature. Normally the temperature of the tips of the toes is about 80 F. and when such reflex vasodilatation is induced it may rise to 96 F. A similar rise is obtained in Raynaud's disease. Thus, when clinical impair-

ment in circulation is accompanied by a normal Landis-Gibbon reaction, it is safe to assume that the disorder is the result of vasospastic disease.

In cases of organic obliterative disease it will be found that the immersion of the opposite extremities in hot water will be accompanied by either a partial rise or none at all. No elevation in skin temperature would be an indication that the phenomenon of arterial obstruction is due entirely to organic occlusion. On the other hand, an elevation of two or three degrees would indicate that although extensive organic disease is present, a potential vascular capacity is still available for which therapeutic procedures should prove of value.

The large number and wide variety of procedures recommended for the treatment of peripheral vascular disease is seen in the accompanying table:

A. Medical
   1. Bed rest
   2. Elimination of all spasm-producing substances
      a. Tobacco
      b. Exposure to cold
      c. Ergot-containing drugs (gynergen)
      d. Ergot-containing foods
B. Physical
   1. Heat by
      a. Baking
      b. Diathermy
      c. Short wave
      d. Baths
         (1) Hydrotherapy
            a. Whirlpool baths
            b. Contrast baths
         (2) Paraffin baths
         (3) Mud baths
         (4) Medicated baths
   2. Massage
   3. Phototherapy
      a. Ultraviolet exposures
      b. Infra-red therapy
   4. X-ray therapy to lumbar spine
   5. Postural exercises
   6. Mercury baths
   7. Iontophoresis
   8. Hyperthermia
   9. Mechanical methods
      a. Suction and pressure
      b. Intermittent venous occlusion
      c. Oscillating bed
C. Surgical
   1. Sympathetic ganglionectomy
   2. Sympathetic ramisection
   3. Periarterial stripping
   4. Vein ligation
   5. Artery ligation
   6. Arteriectomy
   7. Embolectomy
   8. Adrenalectomy
   9. Adrenal denervation
   10. Peripheral nerve section
   11. Paravertebral block
   12. Intraspinal alcohol injection
   13. Chordotomy
   14. Amputations

The authors state that their experience has shown that there is no medical treatment that can equal the profound vasodilatation secured by the use of various physical methods.

Production of Erythema and Tan by Ultraviolet Energy

Matthew Luckiesh and A. H. Taylor, Cleveland. In the J. A. M. A., 112:24:2510, June 17, 1939. (Director and Physicist, Respectively, Lighting Research Laboratory, General Electric Company, Nela Park.)

The ultraviolet wavelength region from approximately 2,500 to 3,500 angstroms encompasses the wavelengths found to be most valuable in the prevention and cure of rickets, the production of erythema and tan in human skin, the killing of germs, and various therapeutic applications. However, the effectiveness of equal amounts of energy at various wavelengths in this region varies enormously for each of these reactions. Some studies of the relative effectiveness of energy of different wavelengths for some of these reactions have been made, notably for the cure of rickets, the killing of germs and the production of erythema.

Although we find that an apparent direct tanning effect with less inflammation can be obtained with the longer wavelengths, the energy density and duration of exposure necessary are prohibitive if one desires to become tanned. A much more efficient and effective method is to expose oneself repeatedly to natural or artificial sunlight, making the exposure sufficient to obtain an appreciable erythema.

In order to determine the exposure required to produce a definite tan, visible after two months or more, twelve subjects were exposed to an artificial sunlight lamp (type S-4) at a distance of 2½ feet. Twelve spots on each subject were given exposures graduated in length from two and one-half to ten min-

utes. The average exposure required to produce a minimum erythema visible one day later was four minutes. The average exposure which produced a minimum tan visible two months after exposure was seven and one-half minutes. Six months after exposure five of the subjects still had spots which were visibly tanned. The ultraviolet rays from this sunlamp are principally in narrow bands at 2,967, 3,022 and 3,120 angstroms. Most of the erythema and tan are produced by the lines at 2,967 and 3,022 angstroms.

Suberythemal doses of ultraviolet rays given three times a week until seven doses were received produced no tan on two persons, but a single exposure of about 70 per cent of the sum of the smaller doses did produce erythema and tan. These results indicate that if tanning is desired the exposures should be long enough to produce some erythema. This is probably true regardless of the type of source, whether sunlight or a sun lamp. Some work done by Dr. H. J. Gerstenberger with which we were in close touch, in which tungsten lamps with ultraviolet transmitting bulbs were used, proved that suberythema exposures or doses of ultraviolet energy can prevent and cure rickets in children. Daily exposures of the order of one-tenth to one-fourth of that required to produce a minimum perceptible erythema were found to be sufficient to bring about recovery.

Treatment of Weak Feet

James Graham, M. D., Springfield, Illinois. In the Illinois Med. J., 75:5:425, May 1939.

Treatment, Acute Weak Feet

Treatment in all cases is directed toward correction of pronation and toward elimination of, or compensation for, the abnormalities producing it.

Acute weak feet that present synovitis and myofascitis with swelling and tenderness are treated with rest. In these acute cases much time is saved in the end by confining the patient to bed until the swelling and tenderness have subsided. When feasible, the feet are enclosed in plaster of paris casts for a period of one to two weeks after the disappearance of the acute symptoms. The casts are applied with the feet in the overcorrected position of varus with good dorsiflexion.

Strapping holds the foot in the varus position and acts as a substitute for the tendinous sling on the inner side of the foot. Adhesive tape is used along or in conjunction with a soft felt pad that is shaped to fit the non-supporting surface of the foot.

Strapping obviously is a temporary measure, and the patient is convinced of this without difficulty.

The use of commercial arch supports is a mistake for the reason that variations of anatomical conformation that are encountered in feet cannot be met by these factory-made, sized appliances.

With the help of a shoemaker, a very satisfactory support is made from leather and harness felt. A pattern of the foot is cut from a piece of paper and is marked just behind the first, third and fifth metatarsal heads, at the calcaneocuboid junction and just anterior to the medial tuberosity of the os calcis. These marks are used as guides and the shape of the concavity of the under surface of the foot is drawn on the paper. The design of the supporting surface is transposed to a pattern of the shoe insole and that part of the pattern anterior to the supporting surface is cut away and discarded. Two pieces of leather are cut out from this finished design with a small flap left on the inner side of the piece that will be the top of the support. The pieces of leather are stitched by a shoemaker to make an envelope and the envelope is filled with harness felt to the proper height.

Treatment, Postural Group

Active treatment of patients with weak feet of the postural type aims at a readaptation of the weight bearing mechanism to the superstructure by postural control. Such specific muscular control is obtained by several maneuvers that impress upon the patient the elements of correct posture and by a series of exercises that brings opposing muscle groups into balance. Since the success of any system of exercises depends upon a discipline that will instill the patient with a consciousness of good posture and at the same time a spirit of cooperation in developing and maintaining it, the system that creates discipline by its directness and simplicity is the most effective.

The exercises are performed three times each day and they are done with the feet bared as soon as possible. Each time, the exercises are preceded by the wall and chair maneuvers so that the patient has a fresh impression of correct posture while he is running through the exercises.

Exercises and Postural Aids:

Twice daily, barefoot as soon as possible,

and toes always straight ahead. Time—six minutes.

1. Wall maneuver. Begin at wall, walk around room five times, checking posture at wall each time.
2. Chair maneuver. Depress and elevate the big toe twenty times (each foot).
3. Neck rotation with muscles on stretch—five times.
4. Arms extended forward and backward with deep breathing—ten times.
5. Touch floor with knees straight—five times.
6. Leg raising, lying on back—five times.
7. Push back into floor and relax alternately—ten times.
8. Up on toes, cupping arches by throwing weight on smaller toes—ten times.
9. Up on toes; roll out on sides and down—ten times.
10. Feet together; roll out on ankles—ten times.
11. Walk across room on toes and back on outer sides of feet—three times.
12. Manipulate feet as directed—five times.

Treatment, Shortened Achilles Group

Treatment of weak feet in the shortened Achilles group must proceed slowly and with great caution. The physician must bear in mind that the objective of treatment is increased length of the Achilles tendon and the calf muscles and that progressive restoration of the natural mechanics of the foot must follow increased Achilles length. The common practice of correcting the shoe environment of the foot before the tendon has been lengthened precipitates an acute weak foot.

The Achilles tendon is lengthened by exercises, passive stretching and by walking with metatarsal bars.

Treatment, Anatomical Group

Weak feet in the short first metatarsal group usually require some permanent mechanical device that will add to the length of the medial pillar. In many cases, however, the action of the peroneus longus can be developed to such an extent that it can carry its extra burden quite effectively without mechanical aid. Such a result is a possibility only when the first metatarsal is not greatly shortened. The muscle is developed by means of the chair maneuver described in a previous paragraph.

The leather insole advocated by Morton has been found to be a very satisfactory form of therapy in this group of cases. A compensating platform is attached to the insole just beneath the first metatarsal head.

Treatment and Management of Burn Cases

H. Jerry Lavender, M.D., Cincinnati, Ohio. Amer. J. Surg., XLV:3:534, September 1939.

My method of choice, in the vast majority of the cases, is the use of a modified, almost forgotten, water-bath or tubbing procedure.

After the administration of a mild narcotic, the patient is lifted into a large bathtub filled with hot water, to which has been added about one pint of aqueous green-soap solution. Canvas hammocks, fastened with hook arrangements to the sides of the tub and adjusted with ease, may be used; they cause little or no discomfort due to the buoyancy of the body in the full tub.

The individual is observed very closely and is permitted to remain in the soap solution for five to ten minutes only, depending upon the general condition and tolerance. He is then lifted to a sterile sheet, and a mechanical debridement of all blisters and loose tissue is done as aseptically as possible, using small pieces of sterile gauze. Care must be exercised to get the areas as clean as possible, especially the edges of the wounds.

The dressings are kept wet continuously with the warm solution but are not changed or removed until the next tubbing period, the following morning, at which time the patient is placed, dressings and all, in the bath containing the soap solution.

On the third or fourth day the patient usually will tolerate a full hour of tubbing and this may be increased gradually to several hours per session.

It is interesting to note with what pleasure patients anticipate the bath procedure; they are, quite often, reluctant to be removed from the tub. The water affords complete relaxation, relieving muscle spasm, pain or discomfort. Movements of the extremities can be accomplished with very little effort. Many patients prefer motion in order to release or remove the dressings themselves, and they become interested in this procedure.

With these daily mild exercises, contractures are, for the most part, either prevented or reduced to a minimum. It is rarely necessary to resort to some orthopedic appliance, but when necessary, this can be applied much earlier by the tub method because the nature and extent of the impending contracture or deformity can be anticipated sooner.

After-Treatment of Poliomyelitis

K. G. Hansson, M. D., New York. In J. A. M. A., Vol. 113, No. 1, July 1, 1939.

Hansson states that the importance of rest and the protection of the weakened muscles have always governed the treatment of drop wrist, drop foot and other forms of peripheral paralysis. The Kendalls of Children's Hospital School of Baltimore have brought back the logical and rational view of the muscle reeducation of patients with infantile paralysis. They have emphasized the neutral or ideal rest position for protection of the entire body. In the protection of the body they included prevention of any stretching or strain of weakened muscles. This was accomplished by the wearing of protective supports, special care in handling the patient during nursing, and physical therapy. They also advocated restriction of the range of joint motion. Assistive movements were not allowed through the whole arc of function until the muscle was able to return actively to its shortened position. The Kendalls also advocated the use of heat, massage and pressure-suction treatment to prevent atrophy of the affected muscles.

Another new idea in the treatment of poliomyelitis came out of Australia under the name of Sister Kenny's method. Mills reported that only 35 patients with the acute form have been treated but claimed the maximum improvement in 1,400 clinic cases. This treatment, used for twenty years, is based on the theory that the pain in the acute form is vascular in origin. The conception of the pathologic process is as follows: At first there is venous stasis. This is followed by capillary stasis and capillary paralysis. As a result mild trophic changes develop in the skin, the joints, the fascia and especially the muscles. Immobilization of paralyzed limbs increases the vascular deficiency, leading to contraction of muscle sheaths and anemia of muscle fibers and fibrosis. The acute form is treated with passive movements and hydrotherapy. The reeducation exercises begin within one week of the onset of paralysis. The restoration of circulation is accomplished by alternating sprays of hot and cold water. Here is a treatment exactly opposite to the one previously described. It disregards rest and immobilization and involves energetic treatment by contrast baths and by movement through every range of joint every two hours. A finely graded system of reeducation exercises is started within the first week of paralytic manifestations.

With the present conception of the pathologic process of poliomyelitis one must accept Kendall's contribution as the more rational one. The objections to his treatment are:

1. If the regeneration of a nerve axon is at the rate of 0.5 mm. daily, it will take twenty days to grow an axon of 1 cm., 200 days for 1 decimeter and 2,000 days, or more than five years, for 1 meter. To keep a patient in bed with muscle protection for five years is neither humane nor practical.

2. Such long inactivity can hardly be imposed on a child without some psychologic injury. Hansson states that he totally ignored the mental attitude of patients with poliomyelitis until three years ago, when he was called to see a girl of 17 who was living on a small farm in Connecticut. She had had poliomyelitis for two years and had been told that nothing more could be done for her. Her paralysis was slight but her mental attitude was that of a village cripple. Hansson sent her to Warm Springs, Ga., and in six months she was walking without assistance, had regained her mental balance and had taken up art, for which she was well suited.

Hansson fails to see the rationale of Sister Kenny's treatment, and it is difficult to subscribe to the conception of pathology on which it is based.

The theory of the author of the after-treatment of poliomyelitis lies somewhere between the extremes described. He believes that there is little or no difference between the treatment of poliomyelitis and any other lower neuron paralysis. There is but little disagreement as to the treatment of a dropped wrist due to radial nerve paralysis or a dropped foot due to paralysis of the anterior tibial nerve. In such cases one supports the weakened muscles, prevents any overstretching and maintains the nutrition and tone of the muscle by heat, gentle massage and reeducation exercises.

In this paper Hansson presents a study of 54 cases of poliomyelitis from the epidemic of 1931 in New York City. The patients were treated under his direction at the Hospital for Ruptured and Crippled and at the New York Hospital. It is not an easy task to evaluate the recovery from poliomyelitis. Very few reports in medical literature actually show the benefit of the treatment. The most valuable report is that of Legg, who studied 53 cases and showed conclusively that

steady follow-up treatment lasting even nine years is not only beneficial in preventing deformities but equally important in increasing muscle power. The subjects for this investigation were patients who were admitted to the hospitals between 1931 and 1935 and were followed at least three years. Their only treatment consisted in underwater exercises in specially constructed therapeutic pools. They were not selected patients.

In the calculation of the percentage of recovery, total paralysis was called zero and normal muscle 100. Any improvement from one grade to the nearest higher grade was therefore 20 per cent, and from zero to 100, or from total paralysis to normal, was 100 per cent. On the muscle-testing chart used 19 muscles are listed in the lower extremity. Each muscle was tested, and the sum of the percentage of recovery of all involved muscles was divided by the number of muscles affected, which gave a percentage of recovery for the whole extremity. The upper extremities and trunk muscles were graded in a similar manner.

When this kind of calculation was applied in the 26 cases in which treatment was begun within six months of the acute onset, the actual muscle improvement taken as a whole was 29.07 per cent, and in 28 cases in which treatment was begun six or more months after the onset the corresponding figure was 16.39 per cent. A comparison of the recovery of the various muscles shows that in the lower extremities the gluteus maximus, gluteus medius and dorsal flexors of the toes showed the greatest recovery and the tibialis anticus and posticus showed the least recovery. In the upper extremities the biceps showed a recovery of 80 per cent and the triceps the lowest recovery, or 29.5 per cent.

Conclusions

Hansson believes that the present consensus as to the aftercare of patients with poliomyelitis is better protection of the weakened muscles and less indiscriminate activity. He asks: "What is then the advantage of underwater exercises?" and "Should one continue to build more or less expensive therapeutic pools?" The answer to these questions is as follows:

1. The temperature of the pools ranges from 85 to 92 F., and thereby the application of heat, so necessary for the circulatory deficiency, is taken care of. Moist heat is better than dry heat, and the even distribution of heat through the contact of water is ideal.

2. The water obliterates the effect of gravity and keeps the weight of an extremity from overstretching the weakened muscle. The motion of the extremity through the water probably produces the best form of massage; manual application of massage may do much harm by excessive pressure on the capillary stasis.

3. The exercises can be performed with just as much care under water as on a table. With the gravity eliminated one has the same resistance to movements in all directions. The physician owes a great deal to the Kendalls for having recalled to him the importance of protection during and after exercises.

4. Nothing can replace the therapeutic pool for the security that the patient feels when supported by the water.

Physical Exercise in Cardiac Conditions

Joseph B. Nylin, Philadelphia, Pennsylvania. In Med. Record, 149:11:373, June 7, 1939.

In the mechanotherapeutic treatment of cardiac conditions, rest—as already mentioned—is a very necessary complement to the exercises. It is evident that a treatment with active exercises would only aggravate the cardiac condition of a patient whose heart had not enough reserve power for his daily routine activities. More than the usual amount of rest, and in some cases, a total curtailment of the patient's activities is, therefore, an essential requirement in any program of exercise for cardiac patients. Not only physical rest, however, but also mental rest is an important element in these conditions. Responsibility, worry, and psychic disturbances should, therefore, be avoided as much as possible.

In regard to the selection and application of exercises, it is obvious that milder measures should be chosen and employed for patients with pronounced deficiency of the heart than for those with a certain amount of cardiac reserve power.

When the most severe symptoms of insufficiency have been overcome, so-called "kneading" movements to the extremities should be added to the massage, and the passive exercises should be extended so as to include movements in the hip and shoulder joints. These exercises should be administered with a limited range of movement at first, the range being gradually enlarged according to the improvement of the patient.

When the reserve power of the heart has improved so that the patient no longer suffers from shortness of breath during rest, but the insufficiency continues to cause dyspnea and abnormally high or prolonged pulse rate and blood pressure after slight physical exertion, active exercises constitute the most important element of treatment. Active exercises may be in the nature of either free or resistive movements. Free active exercises are those that are performed by the patient without either resistance by or assistance from an outside force. Resistive active exercises are those that are performed against the resistance of some outside force. Of the two types of exercises, the resistive naturally place a greater amount of work upon the heart.

There are, however, certain definite rules which must be strictly observed in any program of exercise for heart patients:

1. There should be an interval of at least one hour between a meal and the exercises.
2. No exercise should be taken in the evening, as physical activity at that time easily may interfere with the patient's sleep.
3. The treatment should be progressive in character—from free active movements to resistive exercises.
4. In the beginning the exercises should be taken with the patient in supine position. As the reserve power of the heart increases they may be performed in a sitting and finally in a standing position.
5. In the execution of the exercises it is necessary to take the force of gravity into consideration. For instance, in upward raising of the leg or the trunk with the patient in supine position, the weight of these parts offers considerable resistance to the movement. In order to prevent the exercise from producing a demand on the heart out of proportion to the cardiac strength, it is often necessary that the operator assist the movement. On the other hand, while the patient is moving the leg or trunk back to the horizontal position, it is necessary that the operator give resistance to the exercise to overcome the aid to the movement produced by the force of gravity.
6. Depending upon the amount of cardiac reserve power, the exercises of the extremities should be performed unilaterally or bilaterally and with a limited or normal range of movement.
7. An exercise must not be repeated successively in the same part of the body. However, although it is not permissible to repeat an individual exercise in the same part of the body, the whole set of movements may be repeated if the patient's condition permits.
8. All bilateral exercises of the arms that expand the thorax should be accompanied by inspiration; all those that compress the thorax by expiration.
9. A pause of two to three minutes should follow each individual exercise.
10. Five to ten deep respirations should precede and follow each whole set of exercises.

It is advisable to consider after this the treatment for patients with a somewhat greater reserve power of the heart. To this group belong, among others, patients who are able to engage in mild physical activities and who can take prolonged walks on a level surface without becoming short of breath, but who become dyspneic on participation in somewhat more strenuous physical activities or upon walking up an inclined plane. For this class of patients resistive exercises are of especial benefit. The movement may be administered with more resistance for this group of cases, and types of exercises producing a greater expenditure of cardiac energy may be employed.

Indications and Technic of Iontophoresis

Frances Baker, M. D., San Francisco. In Arch. P. T., XX:4:197, April 1939.

In September 1937, we began the treatment of a small group of patients sent to us from the clinic on varicose veins because their treatment had proved difficult. The technic of Joseph Kovacs was used. Reinforced asbestos paper was saturated with a 0.50 per cent solution of acetyl-beta-methylcholine chloride and wrapped about the leg from knee to foot avoiding ulcers. Malleable metal plates were placed over the asbestos paper and connected to the positive electrode of a galvanic battery. A large, moist pad-electrode was placed on the back. A current of from 20 to 30 ma. was gradually turned on and continued for 30 minutes. Three treatments were given each week. No support, no injections or any treatment other than a petrolatum dressing was used while this method was employed.

Unfortunately our results have been poor. Patient No. 4 stopped treatment because he became continuously worse. He had marked brawny edema but no ulcer when treatment

was started; an ulcer developed while he was under treatment, and he returned to the varicose vein clinic where the ulcer again closed when support was used. One ulcer closed in patient No. 5 but a second opened while under treatment.

We realize that our series of patients treated is too small to permit scientific conclusions. We believe, however, that a new treatment is valuable only when one or more of the following conditions are met:

(1) The percentage of cures or of improvement is higher than by other methods.

(2) The method of treatment is simpler both for the patient and the physician.

(3) The treatment is less expensive.

We have treated five patients with advanced peripheral vascular disease by histamine iontophoresis, employing a 1 to 10,000 solution. Though the reactions were good, the results were not striking. We plan to continue this study. De Takats found that the skin often developed a refractory state, with increased pigmentation and thickening, and decided that liberation of vasodilator substances from the patient's own skin was preferable.

We have treated 41 patients with arthritis by histamine acid phosphate (1 to 10,000) iontophoresis. Patients with arthritis of the cervical vertebrae or with probable changes in the cervical spine which result in neuritis in the arms, causing thickening, numbness, and tingling of hands, frequently react very well to the vasodilatation obtained with histamine iontophoresis. Needless to say, the results are temporary because we are treating symptoms rather than causes. Cervical arthritis is treated by routine medical procedures—heat, massage, postural training, and the like. We have been very pleased with this method of treatment in those patients who have arthritis following injury or infection. We feel that we are reaching the cause—a vasoconstriction due either to direct stimulation of the sympathetic nerves by the injury or to long restriction in a case. This condition rarely occurs in patients under 45 years of age. The condition is stubborn and requires months of care with any method of treatment, but we have found the fingers softer, less thickened and more flexible following this form of treatment than they are after radiant heat or diathermy. All of our patients receive massage and exercise in conjunction with any preliminary method of vasodilatation.

Value of Exercise in Control of Posture

Helen Dobson Denniston, M. D. In Arch. P. T., XX:4:220, April 1939.

Reeducation by Exercise

The procedure in this reeducation by exercise in the experimental group is as follows: To eliminate stimuli from the proprioceptors concerned with the upright position the patient lies supine and relaxes as much as possible. Usually some muscles have to be trained to relax, and if those that are to be reeducated do not relax, then that must be a part of the first lesson. The extensors of the lower back and the pectorals and upper trapezii are frequently overtense, being accustomed to a contracted position in the hollow-back and forward-shoulder upright posture. With the hand of the patient on his chest and neck to feel the texture of the muscles he is encouraged to "let go" and notice how soft they become.

Moving the shoulder back toward the floor may relax the muscles under the patient's hand through the synergic reflex. One hand of the patient then is placed on his abdomen and one under the lumbar region, and he is told to observe the change in the feeling the muscles have while he presses the lower back against his hand and tries to squeeze it against the floor. Inasmuch as this is an exercise for the abdominal muscles he will feel them harden as they contract, and his attention is called to the movement of the pelvis which accompanies it. After experiencing this contraction several times, he is directed to remove the hand from the abdomen and produce the movement of the lumbar region and observe the sensations in the abdominal muscle through propioceptors. He then is directed to repeat the sensation of abdominal contraction many times. In the same way the gluteal muscles are observed by the finger tips and then through the kinesthetic sense during contractions and relaxations. These two groups of muscles are next exercised simultaneously while the patient observes the pelvic tilt which results. As he lies on the back the lumbar region is highly arched and then the movement of tilting the pelvis to flatten the lumbar region is repeated. In this exercise he learns the feeling of the muscle contractions and movements which control the pelvic tilt.

With the patient lying on his face, the arms are extended to the side in line with the shoulders and lifted free from the floor. In

this manner he learns the feeling of contraction in the middle trapezii and rhomboidei muscles for the replacement of his forward shoulders. The resistance to the muscular effort in these three simple exercises is so small that the actual strength of the muscles is very slightly increased. With the patient on the back again he repeats the pelvic tilt holding the position with the muscles contracted while he repeats the sensations of the contractions in the shoulder retractors. Holding these three muscle groups tense he is instructed to remember the feeling. After this has been repeated a sufficient number of times to make further experimentation worth while, the patient then stands in front of a mirror and is instructed to imagine that he is still lying on the floor on his back and then told to contract these three muscle groups and experience the same sensations as before. In the mirror he will observe the movement which results and under the direction of the instructor will produce just sufficient movement to bring his body segments into line so as to conform with the ideal for his body build. This body adjustment is repeated under observation until it needs no further supervision, at which time the patient is ready to repeat the sensations without looking in the mirror and then to observe the results by glancing in the mirror or by having a photograph taken.

Hospitals: Liability of Charitable Hospital for Injury to Pay Patients

From Medicolegal Abstracts, Bureau of Legal Medicine and Legislation. In J. A. M. A., Vol. 113, No. 15, Oct. 7, 1939.

A hospital conducted in the interest of charity, the Supreme Court of Idaho held in *Wilcox v. Idaho Falls Latter Day Saints Hospital*, is not liable to pay patients injured through the negligence of hospital employees, even though the hospital may not have exercised due care in the selection of the negligent employee. The court based its holding on the ground that one who accepts the benefit of a charity enters into a relation which exempts the benefactor from liability for the negligence of his servants in administering the charity. The articles of incorporation of a hospital, the court said, are admissible in evidence to establish a disputable presumption as to the charitable status of the hospital. In this case a child was taken to the hospital for treatment for pneumonia. Her attending physician directed that she be given diathermy treatment. The treatments were administered by a hospital nurse during the course of which the child sustained a severe burn.

In *Sisters of the Sorrowful Mother v. Zeidler*, the Supreme Court of Oklahoma held that a pay patient in a charitable hospital may recover damages for injuries sustained through the negligence of a servant, agent or employee of the hospital. The doctrine of nonliability, the court said, was "repugnant and shocking to a sense of fairness and justice to the victim of what may aptly be termed protected negligence." In this case, a woman was taken to the hospital in a delirious condition. Due, it was alleged, to the negligence of hospital employees in leaving her unattended, she fell or jumped from a second story window, death resulting.—*Wilcox v. Idaho Falls Latter Day Saints Hospital (Idaho)*, 82 *P.* (2d) 849; *Sisters of the Sorrowful Mother v. Zeidler (Okla.)*, 82 *P.* (2d) 996.

Temperature Changes and Changes in Caliber of Retinal Blood Vessels After Short Wave Diathermy

Irving Puntenney, M.D., and Stafford L. Osborne, M.S., Chicago. Arch. Ophthal., 22:2:211, August 1939.

Summary

An experimental study was made on the heating of the conjunctiva, vitreous and orbit by short wave diathermy.

Temperature readings were made on the ocular tissues during the period of cooling, and these readings were combined with those obtained in the first part of the study to make average heating and cooling curves.

The average heating and cooling curves show that the body temperature bears a definite relation to the temperature of the ocular tissues during heating and cooling. These curves are of value in estimating the ocular temperature when only the rectal or the abdominal temperature is known.

It has been shown that it is difficult to localize the heating energy to the eye.

Microscopic studies have been made to determine the pathologic changes which occur following the administration of short wave diathermy.

The need for heating and cooling curve studies in man has been pointed out.

Book Reviews

DISEASES OF THE FOOT. By Emil D. W. Hauser, M.S., M.D., Assistant Professor of Bone and Joint Surgery, Northwestern University Medical School; Attending Orthopedic Surgeon, Passavant Memorial Hospital, Chicago. With a Foreword by Sumner L. Koch, M.D. Cloth. Price, $6.00. *Pp.* 472, *with* 263 *illustrations. Philadelphia: W. B. Saunders Company,* 1939.

Every physical therapist knows that patients with diseases of the feet constitute a large proportion of the cases referred to a physical therapy department for treatment. This volume is written by an orthopedic surgeon who has devoted much time and study to foot conditions. The author states in the preface that he is greatly indebted to Miss Mildred Elson for her help, particularly in the physical therapy sections. Special attention is given to the details of the use of heat, massage and exercise in foot conditions. Therefore, this book should be of great interest to every physical therapist. The illustrations are excellent, many original anatomical drawings being included. Longitudinal and cross sections show the fascial spaces of the foot. The innervation, blood supply of the foot and insertions of the posterior tibial and the long peroneal are shown in unusual detail.

Hauser has given the physician, medical student and physical therapist a comprehensive treatise to serve as a guide in the treatment of diseases of the feet from infancy to adult life. There are chapters on anatomy and embryology, physiology, examination of the foot, hygiene and general care of the feet, pes valgoplanus, treatment of orthopedic conditions of the toes, orthopedic conditions of the accessory bones of the foot, disturbances of the heel, postural disturbances and their relation to the foot, arthrosis, talipes, circulatory disturbances in the feet, fractures of the foot and ankle dislocations, sprains, acute bone atrophy, Köhler's disease of the navicular bone, Freiberg's disease, march foot, rupture of the gastrocnemius muscle and tendo Achillis and recurrent dislocation of the peroneal tendons, diseases of the nerves, diseases of the bones and joints of the foot, infections of the foot, tumors of the foot; diseases of the skin and nails of the foot; care of the feet during pregnancy, following prolonged illnesses and in cases of rickets; technic of local anesthesia, special technic in the care of the feet; technic for manipulation of the foot, and orthopedic appliances for the foot.

The treatment given for these conditions is not a digest of the literature but observations made in an active practice. The use of physical therapy is given a conspicuous place, and this book should be in the library of every physical therapist.

EMOTIONS AND BODILY CHANGES: A SURVEY OF LITERATURE ON PSYCHOSOMATIC INTERRELATIONSHIPS, 1910-1933. *By H. Flanders Dunbar, M.D., Med. Sc. D., Ph. D. Second Edition. With Supplementary Introduction and Additional Bibliography. Cloth. Price,* $5.00. *Pp.* 602. *New York: Columbia University Press,* 1938.

This is the second edition of a work which has already received considerable attention and acclaim. The role of emotions in the production of bodily symptoms is being brought more and more to the attention of the medical profession. The fundamental physiologic research of Cannon and others have shown conclusively that psychogenic processes recognized as fear, rage, sorrow, et cetera, have chemical and physical counterparts which may well resemble signs and symptoms of disease of particular organs and parts of the body. The author has collected in this volume most of the available literature of experimental and clinical data which bears evidence to the role of emotions in illness. Although the material is presented for the most part as statements by the various contributors without criticism by the author, there are several chapters in which she expresses her own opinions which are now widely respected and accepted. Emotional reactions may give rise to disturbances in any of the various systems of the body. There are chapters on the gastrointestinal, cardiovascular, respiratory, genitourinary, nervous and mental and practically every system of the body where the emotions are reflected either subjectively or objectively. The psychosomatic approach to a better understanding of the sick patient is a noteworthy advance in the field of medicine.

A TEXTBOOK OF PATHOLOGY FOR USE IN SCHOOLS OF NURSING. By Armin V. St. George, M.D., Lecturer in Pathology, Bellevue School of Nursing. Second Edition. Cloth. Price, $1.75. Pp. 238, with 20 illustrations. New York: The Macmillan Company, 1938.

This small volume was developed from a series of lectures given in the Training School for Nurses of Bellevue Hospital as a course in pathology. It presents to the nurse a comprehensive view of the major pathologic processes in simple form. It discusses the principal causes of disease, the nature of some of the more common disease processes and the importance of the various diagnostic measures.

In this second edition the chapters on cardiovascular diseases, renal diseases, vitamins and deficiency diseases and tumors were revised. A chapter on gastrointestinal diseases was added. It can be recommended as a textbook for schools of nursing.

HANDBOOK OF PHYSICAL THERAPY. Selections Authorized for Publication by the Council on Physical Therapy of the American Medical Association. Third Edition. Cloth. Price, $2.00. Pp. 537. Chicago: American Medical Association, 1939.

The third edition of this popular handbook has become necessary in order to keep pace with new developments in research and clinical practice. The articles retained from the second edition have been revised. Eleven new articles have been added; these consider fever therapy by physical means, colonic irrigation, the interrupted low frequency and constant electric current in medicine, medical diathermy, electrolysis, physiologic effects of ultraviolet radiation, artificial radioactivity and neutron rays in biology and medicine, physical therapy in the treatment of fractures, in infantile paralysis, in psychiatry and certain neurologic conditions and physical therapy departments in hospitals with fifty or more beds.

This handbook is highly recommended as providing a complete survey of the leading opinions in the field of physical therapy.

SURFACE ANATOMY. By W. E. Roberts, M.R.C.S., L.R.C.P., Hon. Demonstrator of Anatomy, University of Sydney. Foreword by A. N. Burkitt, M.B., B.Sc., Professor of Anatomy, University of Sydney. Cloth. Price 7s. 6d. Pp. 93, with 40 illustrations. Sydney, Australia: Angus & Robertson, Limited, 1937.

The excellent illustrations of this small book on surface anatomy are photographs upon living models. The actual markings of the surface anatomy are shown except that in general the outline of muscles is omitted. Another distinguishing feature is that the complete text description of each figure is printed upon a single page which is placed opposite the figure. It can be recommended to the medical student and physical therapist for reviewing surface anatomy.

HANDBOOK OF PSYCHOBIOLOGY AND PSYCHIATRY. By Edward G. Billings, M.D., Assistant Professor of Psychiatry, University of Colorado School of Medicine; Director, The Psychiatric Liaison Department of the Colorado General and Psychopathic Hospitals; Psychiatric Consultant to the Child Research Council, Denver; U.S.P.H. Psychiatric Consultant to the Federal District Court of Denver. Cloth. Price, $2.00. Pp. 271. New York: The Macmillan Company, 1939.

The purpose of this book is to serve as a guide to the student or general practitioner who is bound to be confronted with psychologic problems in medicine. To treat the difficult and complicated subject of psychiatry in a small volume has been the goal of many writers. Unfortunately packing a great deal of small print into a small volume does not accomplish this. Admittedly the subject of psychobiology entails the use of new terms and phraseology. Studying the patient "as a whole" is the chief purpose of psychobiology. The general practitioner would like to have a better understanding of this subject but the language used in most textbooks and indeed also in the present volume is so bewildering and obscure to all but those especially trained that its value as a guide may be questioned. At any rate, this is an attempt in the right direction and because of its compact size it may entice the interest and scrutiny of those who wish general information on the subject of psychiatry.

MANUAL OF THE DISEASE OF THE EYE. By Charles H. May, M.D., Consulting Ophthalmologist to Bellevue, Mt. Sinai and French Hospitals; formerly Chief of Clinic and Instructor in Ophthalmology, Medical Department of Columbia University, and Director of Eye Service at Bellevue Hospital, New York. With the assistance of Charles A. Perera, M.D., Instructor in Ophthalmology, College of Physicians and Surgeons, Medical Department of Columbia University, New York. Sixteenth edition. Cloth. Price, $4.00. *Pp.* 515, *with* 387 *illustrations. Baltimore: William Wood and Company,* 1939.

This is a concise, practical and systematic manual of the diseases of the eye. Its value is shown by the fact that since 1900 there have been sixteen American, eight British, nine Spanish, six French, six Italian, six Dutch, two German, one Portuguese, two Japanese and three Chinese editions.

In the present edition the chapters on glaucoma, lens, retina, optic nerve and errors of refraction have been rewritten. There is a separate chapter on perforating wounds of the globe and in this chapter compensation for eye injuries is discussed. The visual standards for operating motor vehicles as approved by the American Medical Association have been added to the chapter on amblyopia. This book can be recommended highly to medical students and general practitioners.

YOU'RE THE DOCTOR. By Victor Heiser, M.D. Cloth. Price, $2.50. *Pp.* 300. *New York: W. W. Norton & Company, Inc.,* 1939.

Years ago Sir Francis Bacon stated: "A man's own observation, what he finds good of, and what he finds hurt of, is the best physic to preserve health." For over forty years Doctor Heiser has been concerned with the health and well-being of multitudes of people in many different countries. He, himself, a man now in his middle sixties, is hale and hearty. In this book he discusses such essentials as have proved beneficial to the health of the various people he has seen as well as to his own health.

This book is addressed to the normal person who wants to keep well by intelligent living—by common sense and not by fads. It is easy to read because the principles for a wiser way of living are interspersed with anecdotes and the experiences of the author's travels about the world. It is a book that can be recommended to those patients who read newspaper health columns and ask innumerable health questions.

SUPERFLUOUS HAIR AND ITS REMOVAL. By A. F. Niemoeller, A.B., M.A., B.S. With a foreword by M. H. Marton, M.D. Cloth. Price, $2.00. *Pp.* 155, *with* 3 *illustrations. New York: Harvest House,* 1938.

This volume considers the causes of and the removal of superfluous hair. The available information on the subject is presented in simple language and the book is of value to those doing this work.

TEXTBOOK OF ABNORMAL PSYCHOLOGY. By Roy M. Dorcus, Assistant Professor of Psychology, University of California at Los Angeles, and G. Wilson Shaffer, Psychologist, Sheppard-Enoch Pratt Hospital, Towson, Md.; Lecturer in Psychology, Director of Physical Education, Johns Hopkins University, Baltimore, Md. Second edition. Cloth. Price, $4.00. *Pp.* 492, *with* 36 *illustrations. Baltimore: Williams and Wilkins Company,* 1939.

This is the second edition of a textbook of abnormal psychology which has already taken a first rank place in psychologic and medical literature. The authors present the subject as a study of unusual mental activity which they treat with the most up-to-date scientific approach. They utilize experimental and clinical psychology and physiology in their interpretation of abnormal behavior. Deviations from what is accepted as normal sensation, motion, memory, association, emotions and desires are discussed as an approach to a better understanding of the neuroses and psychoses. The role of organic factors in the production of deficient mentation dissociations of behavior is given due recognition. Nevertheless the overlap between psychogenic factors and physiologic changes is stressed. The book concludes with a brief chapter on treatment in which the various theories of psychotherapy are considered. There is an excellent reference bibliography and the book is highly recommended to graduate students in psychology and medicine.

FUNCTIONAL DISORDERS OF THE FOOT: THEIR DIAGNOSIS AND TREATMENT. By Frank D. Dickson, M.D., F.A.C.S., Orthopedic Surgeon, St. Luke's, Kansas City General and Wheatley Hospitals, Kansas City, and Rex L. Diveley, A.B., M.D., F.A.C.S., Orthopedic Surgeon, St. Luke's, Kansas City General, Research and Wheatley Hospitals, Kansas City, Missouri. Cloth. Price, $5.00. *Pp.* 305, *with* 202 *illustrations. Philadelphia, Montreal and London: J. B. Lippincott Company,* 1939.

Functional foot disorders constitute problems of economic and medical importance. Because of the lack of interest in foot disorders among the medical profession, the treatment of functional foot disorders has fallen into nonmedical hands. The laity generally looks upon the diagnosis and treatment of painful foot conditions as the province not of the physician but of the chiropodist or the shoe salesman. The authors state that it is to meet this situation, as far as the medical profession is concerned, that this book has been written.

The first three chapters present such facts on the evolutionary development, the anatomy and the physiology of the foot as are necessary to an understanding of the foot as a functioning organ and to an appreciation of the departures from normal. There also are chapters on the primary causes of foot imbalance; the examination of feet; the foot of childhood; foot imbalance in childhood, adolescence and in the adult; foot apparel; hallux; affections of the nails, skin, the tarsal and metatarsal bones and the heel; constitutional diseases affecting the feet; foot strapping and foot exercises. This book can be recommended to the medical profession as presenting fundamental knowledge and the practical treatment of functional disorders of the foot.

ELEMENTARY ANATOMY AND PHYSIOLOGY. By James Whillis, M.D., M.S., F.R.C.S., University Reader in Anatomy, Guy's Hospital Medical School London; late Lecturer in Anatomy in the University of Durham. Foreword by T. B. Johnston, M.D., Ch.B., Professor of Anatomy, University of London. Cloth. Price, $3.50. *Pp.* 342, *with* 87 *illustrations. Philadelphia: Lea & Febiger,* 1939.

Johnston in his foreword states that the intimate relationship existing between structure and function, properly stressed and adequately presented, is capable of arousing real interest in the mind of the average medical student. He gives his students a short course of introductory lectures to anatomy of a very elementary and general character. Johnston believes that this method as is given in this book provides the right approach to the study of human anatomy, no matter how deeply they may tend to delve into it subsequently.

There is no doubt that this is a good theory, but there is a question as to whether this book is complete enough properly to emphasize and correlate structure and function for the average medical student in the United States who must study so much of his anatomy in his first year. It can be recommended for nurses and others who need an elementary treatment of these subjects during their period of training.

INJURIES OF THE NERVOUS SYSTEM, INCLUDING POISONINGS. By Otto Marburg, M.D., Clinical Professor of Neurology, Columbia University; Research Neuropathologist, Montefiore Hospital, New York, and Max Helfand, M.D., Assistant Clinical Professor of Neurology and Psychiatry, Columbia University; Chief of Nerve Clinic, Post-Graduate Hospital; Association Attending Neurologist and Psychiatrist, Welfare Hospital; Attending Neurologist and Psychiatrist, Department of Correction, New York. Cloth. Price, $3.00. *Pp.* 224, *with* 16 *illustrations. New York: Veritas Press, Inc.,* 1939.

In this fast-moving world of the present, the incidence of injuries seems to be getting higher and higher. Therefore, accidents and industrial hazards frequently are responsible for invalidism. The nervous system is particularly prone to trauma and this book is an attempt to summarize the more common lesions of the brain, spinal column and peripheral nerves.

The earlier chapters deal with concussions, contusions and compressions. The later chapters are devoted to the effects of various industrial and occupational poisonings. The material is presented in a very general form. It would appear that inasmuch as this is a treatise on such specific topics, the authors might have gone more into detail. This no doubt will be done in future editions.

PHYSICAL DIAGNOSIS: THE ART AND TECHNIQUE OF HISTORY TAKING AND PHYSICAL EXAMINATION OF THE PATIENT IN HEALTH AND IN DISEASE. By Don C. Sutton, M.D., Associate Professor of Medicine, Northwestern University School of Medicine, Chicago. Cloth. Price, $5.00. *Pp.* 495, *with* 306 *illustrations. St. Louis: C. V. Mosby Company,* 1937.

Physical diagnosis is the basis for the practice of medicine. For the medical student the study of physical diagnosis is his first approach to the handling of the patient. This book is a recognized text for the student and the physician who must know the physical signs of disease. The book is amply illustrated; its language is clear and practical. It includes more clinical material than the older textbooks on physical diagnosis and may be highly recommended.

A TEXTBOOK OF OCCUPATIONAL DISEASES OF THE SKIN. By Louis Schwartz, M. D., Medical Director, United States Public Health Service in Charge of Dermatoses Investigations, Washington, D. C., and Louis Tulipan, M.S., Clinical Professor of Dermatology and Syphilology, New York University College of Medicine, New York City. Cloth. Price, $10.00. *Pp.* 799, *with* 116 *illustrations. Philadelphia: Lea and Febiger,* 1939.

This book offers systematic and well organized information concerning a special branch of dermatology. It is not only of great interest to the dermatologist but also to the industrial physician who has to deal with the skin lesions which result from work in the various industrial processes. The book is very interestingly written and it would be time well spent for any one to read. The authors carefully avoid the difficulty of going into too great detail both with regard to complicated structural chemical formulae and to more or less meaningless trade names of substances whose compositions would be unknown to the reader. The material is arranged by trades, occupations, and professions, and also in the back of the book, some fifty pages are devoted to a list of chemicals which are known to be, or which can be, skin irritants. The index is exhaustive and of great value in locating different substances and their uses. Because of the decidedly practical viewpoint taken in presenting this encyclopedic material there is much practical advice given which would be helpful in making an etiological diagnosis in a given case. The authors have incorporated in the book not only their own extensive observations for which they have a peculiar opportunity but also have gone exhaustively into the literature. They have furnished references at the end of each chapter which give the reader the opportunity of more extensive study of his problem if he should so desire. The authors also are careful not to involve their readers in to great dermatological descriptions (including histology). The clear photographs help to give the reader a much more accurate impression of the type of skin disorders produced. The reader will be very much impressed by the tremendous scope of the book, with its lucid and compact presentation as well as its wealth of new material. This book fills a distinct need in this country and will prove more and more indispensable as a reference book to anyone who is interested in a simple and concise statement of the industrial processes themselves or in the health hazards presented by these multiple and decidedly modern materials.

FRACTURES AND DISLOCATIONS IN GENERAL PRACTICE. By John Hosford, M.D., F.R.C.S., Assistant Surgeon to St. Bartholomew's Hospital, London; Late Hunterian Professor, Royal College of Surgeons. Cloth. Price, 12s. 6d. *Pp.* 274, *with* 71 *illustrations. London: H. K. Lewis & Co., Ltd.,* 1939.

This small volume on fractures aims to give more practical help and detail regarding fracture treatment than appears in the ordinary textbook of general surgery but yet is not nearly so long as many of the complete treatises on this subject. The details of open operation on fractures and the complicated methods of skeletal traction have been omitted.

It is divided into two parts. The first part gives the general considerations of diagnosis and treatment, the use of plaster of paris, continuous traction, operative treatment, open fractures, delayed and nonunion, malunion, complication of fractures and dislocations. Part two discusses the treatment of various fractures and dislocations. This volume can be recommended to general practitioners.

CUTANEOUS CANCER AND PRECANCER. By George M. Mackee, M.D., Professor of Clinical Dermatology and Syphilology and Director of Skin and Cancer Unit, New York Post-Graduate Medical School and Hospital, Columbia University, and Anthony C. Cipollaro, M.D., Associate in Dermatology, Skin and Cancer Unit, New York Post-Graduate Medical School and Hospital, Columbia University. With a foreword by Francis Carter Wood, M.D. Cloth. Price, $3.75. Pp. 222, with 245 illustrations. New York: The American Journal of Cancer, 1937.

The authors state that this monograph was prepared with the idea of reducing the mortality from accessible cancer. It is a manual based on undisputed facts and experience. The symptomatology, diagnosis, etiology, pathology and treatment of precancer and cancer of the skin and mucosa are presented concisely and practically in the text and the various lesions are shown in many excellent illustrations. There are many photomicrographs. For those interested in any particular phase of the subject there is an excellent bibliography. In the final section there is an analysis of the established therapeutic methods without any effort being made to describe in detail the technic to be employed as the authors believe the physician should consult the special works dealing with this subject for the exact technic of treatment.

The value of early diagnosis and prompt and adequate treatment of cutaneous cancer cannot be overemphasized. This book is highly recommended as a valuable aid for these purposes. Those interested in physical therapy are constantly examining and treating the skin. It is extremely important that they have a knowledge of these precancerous dermatoses and cutaneous cancer to see that the patient gets early and adequate treatment.

THE 1938 YEAR BOOK OF GENERAL THERAPEUTICS. Edited by Bernard Fantus, M.S., M.D., Professor of Therapeutics, University of Illinois College of Medicine; Member, Committee on Revision of the United States Pharmacopoeia and of the National Formulary Revision Committee; Director of Therapeutics, Cook County Hospital, and Aaron L. Goldberg, M.D., Assistant in Medical Dispensary at University of Illinois. Cloth. Price, $2.50. Pp. 544, with 44 illustrations. Chicago: Year Book Publishers, 1939.

These year books on general therapeutics have always been most valuable as they present a rich collection of useful therapeutic data. This volume is of interest to physical therapists as nearly one hundred pages are devoted to the use of physical agents. Under hydrotherapy the specifications of Boynton's homemade whirlpool bath and Currence's method of underwater treatment of arthritis are given. The use of massage in fibrositis as used by Krusen is discussed.

Other subjects of interest to the physical therapist are exercises for the spastic child, physical therapy in peripheral vascular diseases, the new developments in the use of ultraviolet and infra-red radiation, short wave diathermy, spa therapy and occupational therapy. It can be highly recommended to every physician.

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